DELAWARE VALLEY SCHOOL DISTRICT

PLANNED INSTRUCTION

A PLANNED COURSE FOR:

Biology

Grade Level: 10

Date of Board Approval: 2018

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

DELAWARE VALLEY SCHOOL DISTRICT

Planned Instruction

Title of Planned Instruction: Biology

Subject Area: Biology Grade(s): 10

Course Description:

This course provides an overview of the essential topics in biology that include, but are not limited to, basic biological principles; cellular structure and function, including homeostasis and transport; biochemistry; bioenergetics, including photosynthesis and cellular respiration; cell growth and reproduction; DNA and Mendelian genetics; evolutionary principles; and the classification and interaction of living things. Each unit underscores the role of biology in the life of the student and will attempt to present relevance to present-day scientific issues in society. Each unit will focus on significant themes in biology that stress the study of life, the continuity of life, the diversity of life, and the way in which living organisms are influenced by their environment. Students with diverse learning styles will have the opportunity to use a variety of learning methods to attain mastery of the skills and concepts necessary for success. These methodologies include direct instruction, laboratory activities and/or demonstrations, hands-on creative projects, interaction with various text and media, collaboration with peers, guided inquiry, and written assignments. This course is part of the planned science curriculum at Delaware Valley High School.

Time/Credit for the Course: One full year, meeting daily for 46 minutes/ 1 credit

Curriculum Writing Committee: Danielle Giordano, Lindsay Baker

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DELAWARE VALLEY SCHOOL DISTRICT

Curriculum Map

1. **Marking Period One -Overview with time range in days: 45**
   UNIT 1: Nature of Science, Themes of Biology, and Ecology
   UNIT 2: Biochemistry

   Marking Period One -Goals:
   Understanding of:
   - Preassessment of Student Knowledge
   - Scientific Method and Experimentation
   - Themes of biology
   - Ecology
   - Biochemistry

2. **Marking Period Two -Overview with time range in days: 45**
   UNIT 3: Structure and Function of Cells, Cellular Processes and Homeostasis
   UNIT 4: Bioenergetics - Photosynthesis and Cellular Respiration

   Marking Period Two -Goals:
   Understanding of:

   - The Discovery of the Cell and Cell Theory
   - Microscopy Skills
   - Structure and Function of Prokaryotic and Eukaryotic Cells
   - Homeostasis and Cell Transport – Active and Passive Transport
   - Chemical Reactions and Energy Transformations involved in Photosynthesis and Cell Respiration

3. **Marking Period Three -Overview with time range in days: 45**
   UNIT 5: DNA structure, Replication, Transcription, and Translation
   UNIT 6: Cell Reproduction (Mitosis), Production of Sex Cells (Meiosis)
   UNIT 7: Mendelian Genetics and Biotechnology

   Marking Period Three -Goals
   Understanding of:

   - DNA Structure
   - DNA Replication
   - DNA Transcription
   - DNA Translation
   - Sexual vs. Asexual Reproduction
   - Cell Division and Mitosis

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- Cancer
- Production of Sex Cells and Meiosis
- Karyotyping
- Genetics Terminology
- Inheritance Patterns and Probability
- Genetics of Blood Typing
- Pedigree Analysis
- Genetic Engineering

4. **Marking Period Four –Overview with time range in days: 45**
   UNIT 8: Evolutionary Principles
   UNIT 9: Classification

   Marking Period Four -Goals:
   Understanding of:

   - Evolution's Significance in Biology
   - Evidence of Evolution
   - Charles Darwin and Natural Selection
   - Adaptations
   - Taxonomy
   - Eubacteria/Archaea and the (former) Kingdom Monera
   - Fungi Kingdom
   - Protist Kingdom
   - Plant Kingdom
   - Animal Kingdom

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DELAWARE VALLEY SCHOOL DISTRICT

Curriculum Plan

Unit 1: Themes of Biology/Nature of Science and Ecology

Time Range in Days: Approximately 25 days

Standards:
PA Academic Standards
PACCS Reading and Writing for Science and Technology

Anchor(s): Biology Keystone Anchors
BIO.B. 4.1.1, BIO.B.4.1.2, BIO.4.2.1, BIO.4.2.2, BIO 4.2.3, BIO.4.2.4, BIO.4.2.5

Standards Addressed:
3.1.B.A9, 3.1.B.B6., 3.1.B.C4., 4.1.10.F., 4.2.10.D., 4.4.10.E., 3.1.10.A1., 3.1.B.A8., 3.1.B.A1., 4.1.10.A., 4.1.10.C., 4.5.10.D, 4.1.10.E

Anchors:
S11.A.1.1, S11.A.1.3 , S11.A.2.1 , S11.A.3.1, S11.A.3.2, S11.B.1.1, S11.B.3.1, S11.B.3.2, S11.C.2.2,

Big Idea # 1: Organisms share common characteristics of life.

Essential Questions:
How do we know if something is alive?

Concepts:

- Organisms are made up of simpler units called cells.
- Organisms seek to maintain homeostasis at all biological levels of organization.
- Organisms grow, develop and eventually die.
- Organisms can reproduce their own kind using DNA.
- Organisms adapt to changes in their environments.

Competencies:

- Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.
- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.

Big Idea #2: Structure is related to function at all biological levels of organization.

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

Essential Questions:
How is structure related to function at all biological levels of organization?

Concepts:

- Biological levels of organization from smallest to largest include: atoms, molecules, organelles, cells, tissues, organs, organ systems, multicellular organisms, populations, and communities.
- The pattern of form following function is reflected at all biological levels of organization.

Competencies:

- Cite examples of how structure is related to function at all biological levels of organization.
- Compare and contrast the structural and functional similarities and differences among living things.
- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.

Big Idea #3:
Organisms on Earth interact and depend in a variety of ways on other living and nonliving things in their environments.

Essential Questions:
How do organisms interact and depend on each other and their environment for survival?

Concepts:

- All forms of life on Earth are connected in a Biosphere.
- Specific biotic and abiotic factors characterize biomes and their component ecosystems.
- Organisms and their environment are interdependent.
- Sunlight is the initial energy source for most life on Earth.
- Energy is converted from one form to another as it moves through a food chains and food webs.
- Matter flows through an ecosystem using a variety of natural cycles.
- Limiting factors can cause population fluctuations or extinction in a given ecosystem.

Competencies:

- Describe the flow of energy through living systems.
- Compare and contrast the structural and functional similarities and differences among living things.
- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

- Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.

Overview:
Students will identify major ideas in scientific research and essential themes in biology; specifically, characteristics (all living things are made of a genetic code, grow and develop, respond and adapt, reproduce, maintain homeostasis, obtain and use energy for life processes, are made of cells, evolve); the organization (cell→tissue→organ→organ system→organism); and the classification of living things. In doing so, students will be provided with a brief overview of the kingdoms of life that will prepare them for subsequent units of study. Additionally, students will identify ways in which organisms interact with one another and their environment and how living things are organized from an ecological standpoint.

Focus Questions:
- What is the scientific method and how is it used for scientific investigations?
- What are the characteristics that define a living thing?
- How are living things organized?
- What criteria are used to group organisms based on similarities?
- What is taxonomy?
- How is an organism named?
- Why is it important to use a common language when naming organisms?
- What is the taxonomic order?
- What are the major groups within which organisms are currently classified?
- What are some ways that organisms interact with one another and their environment?
- How is energy transferred in the biosphere?
- How are nutrients recycled?
- What is a symbiotic relationship?
- How does climate affect an ecosystem?
- What causes changes in a population?

Goals:
- For students to better understand how scientific research and investigation applies to real-world situations and to identify patterns in nature by identifying the many factors that help to define ecology and the ways in which living things interact with each other and their environment.

Objectives:
(Students will be able to)
1. State the goals of science (DOK 1)
2. Recall the steps of the scientific method (DOK 1)

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3. Conduct and analyze one or more scientific investigations (DOK 2 and DOK 4)
4. Explain how scientific attitudes generate new ideas (DOK 3)
5. Assess the importance of peer review (DOK 3)
6. Explain what a scientific theory is (DOK 3)
7. Connect the relationship between science and society (DOK 4)
8. Distinguish the ways by which life can be studied at different levels (DOK 2)
9. Identify major themes in biology by describing the characteristics of living things and relating them to real-life examples (DOK 1)
10. Identify patterns in the sequential organization of living things by recognizing examples in nature. (cell→tissue→organ→organ system→organism) (DOK 2)
11. Cite evidence of how structure relates to function (pertaining to molecules, cells, organs, etc.) (DOK 3)
12. Describe the goals of binomial nomenclature and systematics (DOK 1)
13. Name the six kingdoms of life as they are currently identified (DOK 1)
14. Explain what the tree of life represents (DOK 1)
15. Develop a logical argument that all organisms share common characteristics (DOK 3)
16. Define ecology and describe the methods used to study ecology (DOK 1)
17. Distinguish between the ecological levels of organization of living things (species→population→community→ecosystem→biome→biosphere) (DOK 2)
18. Distinguish between biotic and abiotic factors and identify ways in which they influence an ecosystem (DOK 2)
19. Define primary producer and autotroph (DOK 1)
20. Identify the processes of photosynthesis and how it relates to autotrophs. (DOK 1 and DOK 2)
21. Define consumer (primary, secondary, tertiary) and heterotroph and identify patterns in which they obtain energy and nutrients (DOK 1 and DOK 2)
22. Trace the flow of energy through living systems through food chains and food webs (DOK 2)
23. Compare a food chain to a food web (DOK 3)
24. Identify cycles as patterns in nature and differentiate between the water cycle, carbon cycle, nitrogen cycle, and phosphorus cycle (DOK 2 and DOK 3)
25. Assess ways in which climate shapes an ecosystem (DOK 3)
26. Distinguish between global warming and the Greenhouse Effect (DOK 2)
27. Define and provide an example of a niche (DOK 1)
28. Analyze the role competition plays in shaping communities (DOK 4)
29. Analyze the role predation and herbivory play in shaping communities (DOK 4)
30. Differentiate between the three types of symbiotic relationships in nature (mutualism, commensalism, parasitism) (DOK 3)
31. Cite evidence of ways that ecosystems recover from a disturbance (DOK 3)
32. Compare succession after a natural disturbance with succession after a human-caused disturbance—provide real-life examples (DOK 3)
33. Distinguish between primary and secondary succession (DOK 2)
34. Describe and compare the characteristics of the major land biomes (DOK 1, 2)
35. Discuss the factors that affect aquatic ecosystems (DOK 1)

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36. Identify the major categories of freshwater ecosystems (DOK 1)
37. Describe and compare the distinct ocean zones that make up marine ecosystems (DOK 1, 2)
38. List the characteristics used to describe a population (DOK 1)
39. Identify factors that affect population growth (DOK 1)
40. Distinguish between exponential growth and logistic growth (DOK 2)
41. Identify factors that determine carrying capacity (DOK 1)
42. Cite evidence of limiting factors that affect a population (DOK 3)
43. Investigate the trend of human population growth (DOK 3)
44. Assess human activities that can affect the biosphere (DOK 3)
45. Cite evidence of human activities that affect air resources (DOK 3)
46. Define biodiversity and explain its value (DOK 1)
47. Develop a logical argument pertaining to current threats to biodiversity (DOK 3)
48. Argue ways in which biodiversity can be preserved (DOK 3)
49. Assess the role of ecology in a sustainable future (DOK 3)

Core Activities and Corresponding Instructional Methods: (The teacher is recommended to)

1. Ask students to read and discuss chapter 1, section 1 ("What is Science?") and section 2 ("Science in Context"), to define what science is, science methodology, and factors that affect science and society.
2. Complete a read-aloud, discussion, and/or assessment pertaining to historical examples of scientific experiments, (example: Redi's Investigation of Spontaneous Generation*) to recall the steps of the scientific method. In doing so, students will gain a deeper understanding of what science is and how certain scientific investigations have helped pave the way for current thinking in science. Also, students will practice identifying the controlled, independent and dependent variables of the experiments
3. Ask students to brainstorm possible "problems" in society that could be tested using the scientific method. Students will hypothesize solutions to the problems, with the understanding that each hypothesis should be able to be tested.
4. Use a demonstration or video to allow students to observe the scientific method using a very simple, yet real-world example (example: "Hot Chocolate Lab"*).
5. Have the students perform a lab to practice writing a hypothesis, identifying variables, conducting, and analyzing an investigation.
6. Ask students to read and discuss chapter 1, section 3 ("Studying Life"), to identify eight unifying characteristics of living things and to understand big ideas in biology and fields of biology. Students should compare examples of each of the characteristics.
7. Have students watch the Bozeman Biology videos (via YouTube) "Eukarya" (7:14) and "Hierarchy of Life" (14:26) and complete the accompanying video sheets to better understand classification and taxonomy.
8. Ask students to read and discuss chapter 3, sections 1("What is Ecology"), section 2 ("Energy, Producers, and Consumers"), and section 3 ("Energy Flow in Ecosystems"), to review ecology and the organization of living things and the pathway of energy flow in ecosystems. The teacher should present vocabulary and concepts in chapter 3, sections

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1, 2, 3, in a way that students can use as a study tool and mastery of the main ideas and terminology.

9. Have the students create a mobile or some sort of graphic organizer that displays the ecological organization of living things specific to one of the major biomes of the world.*
10. Model the proper way to dissect an owl pellet and then monitor the students to complete the entire "Owl Pellet Lab."* During the lab, students will collect and display evidence of predator/prey relationships and to review energy flow in ecosystems.
11. Ask the students to read and discuss chapter 3, section 4 ("Cycles of Matter"), to review biogeochemical cycles in nature. Additionally, the teacher should present vocabulary and concepts in chapter 3, sections 4, in a way that students can use as a study tool and mastery of the main ideas and terminology. (Example: Frayer Model—see Appendix)
12. Ask the students to read and discuss chapter 4, sections 1 ("Climate"), section 2 ("Niches and Community Interactions"), and section 3 ("Succession"). The teacher should present vocabulary and concepts in chapter 4 in a way that students can use as a study tool and mastery of the main ideas and terminology.
13. Lead a discussion about evidence of relationships in nature based on what students have witnessed firsthand, what they have seen in television shows or videos, or what they have been shown in school by the current teacher or previous teachers.
14. Guide the students through a cooperative learning activity that will allow them to demonstrate succession through a series of drawings.
15. Have the students create a brochure, poster, media presentation or participate in a "VideoQuest" to review the Earth's major biomes. The teacher will provide a graphic organizer that the students will complete during the "VideoQuest"* and use as a study tool.
16. Ask the students to read and discuss chapter 5, sections 1 ("How Populations Grow"), section 2 ("Limits to Population Growth"), and section 3 ("Human Population Growth"). The teacher should present vocabulary and concepts in chapter 5 in a way that students can use as a study tool and mastery of the main ideas and terminology.
17. Review how to analyze different types of population graphs (logistic, exponential, age-structure) and apply previous knowledge of community interactions (predator-prey relationships; competition; limiting factors; etc.). The teacher should then provide opportunities for students to analyze the graphs cooperatively or independently.
18. Lead a discussion of human population growth, the factors that are affecting changes in human populations, and the ways that the U.S. population compares to the population of other countries.

Assessments:

Diagnostic:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Pre-assessment Resources
    - "Alphabox"*

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

- "Carousel Brainstorm" *
- Open response questions ("What are your thoughts on…?")
- Vocabulary Assessment(s) of prior knowledge
- Word Sorts *

Formative:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Chapters 1, 3, 4, 5 worksheets
- Teacher-generated assignments
- Laboratory Exercises
- Graphic Organizers (See Appendix)
- Paper Models
- Activities and Review Games
- Common Assessment

Summative:

- Chapter Quizzes
- Unit Test – chapters 1, 3, 4, 5
- Individual research-based project – based on discretion of the teacher

Extensions:

- Case Studies - current event that pertains to an ecological issue
- Guided Reading of Supplemental Resources
- Interactive Activities on Websites*
- Video Resources*

Correctives:

- Reread Chapters 1, 3, 4, 5, in *Biology* and complete quizzes at end of each chapter -Chapter Worksheets
- Give students supplemental vocabulary review materials
- Give students web-based resources that reinforce the material presented in class
- Give students extra practice identifying variables in an experiment
- Give students extra practice identifying examples of relationships in nature
- Reteach and retest important concepts including mandatory vocabulary

Materials and Resources:

- Primary Textbook – see chapters and sections within Core Activities
- Supplemental readings
- Supplemental assignments and activities (See Appendix)
- *Study Island*

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- SAS Website
- Internet Resources*

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DELAWARE VALLEY SCHOOL DISTRICT

Curriculum Plan

Unit 2: Biochemistry

Time Range in Days: Approximately 20 days

Standards:
PA Academic Standards
PACCS Reading and Writing for Science and Technology

Anchor(s): Biology Keystone Anchors
BIO.A.3.1.1, BIO.A.3.2.1, BIO.A.3.2.2, BIO.A.2.1.1, BIO.A.2.2.1, BIO.A.2.2.2, BIO.A2.2.3, BIO.A.2.3.1, BIO.A.2.3.2

Standards Addressed:
3.1.B.A9, 3.1.B.B6., 3.1.B.C4., 4.1.10.F., 4.2.10.D., 4.4.10.E., 3.1.10.A2, 3.1.10.A7., 3.1.10 B5., 3.1.B.A2., 3.1.B.A7.

Anchors:
S11.A.1.1, S11.A.1.1, S11.A.2.2, S11.C.1.1

Big Idea # 1: Life emerges due to the chemical organization of matter into cells.

Essential Questions:
How does life result from chemical structure and function?

Concepts:

- Many biological molecules are polymers made from monomers that contain carbon chemically bound with other elements.
- Cells function as microscopic chemical factories synthesizing and degrading biological molecules necessary for life.
- Cells are composed mostly of: C, H, N, O, P, and S.
- Molecular structure is related to function.
- Carbon rings and chains form the backbone of all biological molecules.
- Biological molecules produced by a cell can be used by the cell or transported outside for use by other cells.
- Carbohydrates, lipids, proteins, and nucleic acids are the chemical foundations for life.
- Liquid water forms hydrogen bonds, is a solvent, and forms hydronium ions allowing a wide range of biochemical reactions to occur.

Competencies:

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

- Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
- Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.

Big Idea #2: Structure is related to function at all biological levels of organization.

Essential Questions:
How is structure related to function at all biological levels of organization?

Concepts:
- The pattern of form following function is reflected at all biological levels of organization.
- Biological levels of organization from smallest to largest include: atoms, molecules, organelles, cells, tissues, organs, organ systems, multicellular organisms, populations, and communities.

Competencies:
- Compare and contrast the structural and functional similarities and differences among living things.
- Cite examples of how structure is related to function at all biological levels of organization.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.

Overview:
Students will identify the chemical basis of living things including the major molecules and elements that are present in living cells and tissues; distinguish between types of bonds that form molecules and compounds; describe properties of water and the significance of the molecule in living systems; distinguish between acids and basis and identify ways that pH affects the functioning of living systems; and identify and describe the structure and function of organic macromolecules, including carbohydrates, lipids, proteins, and nucleic acids.

Focus Questions:
- What are elements are found in living things?
- What is an atom and what components make up an atom?
- How are molecules and compounds formed?

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- Why is water so important in living systems?
- What is the difference between an acid and a base?
- What are the four types of macromolecules and how are they alike or different?

Goals:

- For students to better understand the chemical basis of life by identifying major elements and molecules that are found in all living things and the factors that can affect the structure and functioning of such molecules.

Objectives:
(Students will be able to)

1. Identify and distinguish between the three subatomic particles found in atoms (DOK 1, 2)
2. Describe the two main types of chemical bonds (DOK 2)
3. Identify patterns about the unique properties of water (DOK 2)
4. Differentiate between solutions and suspensions (DOK 3)
5. Compare acidic solutions and basic solutions (DOK 3)
6. Relate the properties of carbon to its significance in many different structural and functional characteristics of living things (DOK 2)
7. Differentiate between the structures and functions of each of the four groups of macromolecules (DOK 3)
8. Apply concepts learned when studying proteins to the understanding of metabolic functions (enzymes) (DOK 4)

Core Activities and Corresponding Instructional Methods: (The teacher is recommended to)

1. Ask the students to read and discuss chapter 2, sections 1 ("The Nature of Matter") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology
2. Have students analyze the periodic table by demonstrating how to interpret the labels and how to use the information for constructing an atom (electron configurations)
3. Have students create a one-dimensional/paper model of an atom*
4. Use visuals/animations to display the formation of covalent and ionic bonds
5. Ask students to read and discuss chapter 2, section 2 ("Properties of Water") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology
6. Use a demonstration to display simple properties of water like cohesion, adhesion, surface tension, and capillary action (ex. Drops on a penny; blowing bubbles; dropping pennies into a glass of water)
7. Allow the students to observe how to identify acids and bases by displaying the acidity or alkalinity of regular household products using litmus paper (or show video)
8. Ask students to read and discuss chapter 2, section 3 ("Carbon Compounds") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology

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9. Use graphic organizers or reference cards to reinforce structural and functional features of macromolecules
10. Have students create visible/tangible displays of macromolecules to reinforce the relationship between monomer and polymer*
11. Have students perform a lab activity to identify macromolecules in an unknown substance using chemical properties (Murder/Stomach Contents Investigation Lab)
12. Ask students to read and discuss chapter 2, section 4 ("Chemical Reactions and Enzymes") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology
13. Demonstrate how enzymes work using a lab activity

Assessments:

Diagnostic:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Pre-assessment Resources
    - Open response questions ("What does an atom look like?")
    - Vocabulary Assessment(s) of prior knowledge
    - Word Sorts *

Formative:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Chapter 2 worksheets
- One-dimensional model of atom*
- Teacher-generated assignments
- Laboratory demonstrations/investigations
- Graphic Organizers *
- Activities and Review Games
- Common Assessment

Summative:

- Chapter Quizzes
- Unit Test – Chapter 2

Extensions:

- Guided Reading of Supplemental Resources – "New Biochemical Changes Found in Children With ADHD"*
- Find another current event related to biochemistry and summarize it

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

- "NOVA: Can I Eat that?" with constructed response questions
- Science360 videos (Cheeseburger Science, Chalk Talk, Chemistry Now)
- Molecule Application on iPad

Correctives:

- Reread Chapter 2 in *Biology* and complete quizzes at end of each chapter - Chapter Worksheets
- Give students supplemental vocabulary review materials
- Give students web-based resources that reinforce the material presented in class
- Reteach and retest important concepts including mandatory vocabulary

Materials and Resources:

- Primary Textbook - see chapters and sections within Core Activities
- Supplemental readings
- Supplemental assignments and activities
- *Study Island*
- SAS Website
- Internet Resources*

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

DELAWARE VALLEY SCHOOL DISTRICT

urriculum Plan

Unit 3: Cell Structure and Function

Time Range in Days: Approximately 25 days

Standards:
PA Academic Standards
PACCS Reading and Writing for Science and Technology

Anchor(s): Biology Keystone Anchors
BIO.A.1.1.1, BIO1.A.A, BIO.A.2.1.1, BIO.A.4.1.1, BIO.A.4.1.2, BIO.A.4.1.3

Standards Addressed:
3.1.B.A9, 3.1.B.B6., 3.1.B.C4., 4.1.10.F., 4.2.10.D., 4.4.10.E., 3.1.10.A2, 3.1.10.A5, 3.1.10.A6., 3.1B.A1., 3.1.B.A5

Anchors:
S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3

Big Idea #1: Organisms share common characteristics of life.

Essential Questions:
How do we know if something is alive?

Concepts:

- Organisms are made up of simpler units called cells.

Competencies:

- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.

Big Idea # 2: New cells arise from the division of pre-existing cells.

Essential Questions:
How do cells grow and reproduce?

Concepts:

- Prokaryotic cells divide via binary fission.
- Cell differentiation occurs many times during development of a multicellular organisms giving rise to a diversity of cell types.
- Eukaryotic cells first divide their nucleus and then divide their cytoplasm to make new cells.

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

- Cells grow when they can take in more nutrients through their plasma membranes than they can metabolize in their interior. Cells may divide when their metabolism exceeds nutrient absorption.
- All cells go through a cell cycle.

Competencies:

- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.

Big Idea # 3: Life emerges due to the chemical organization of matter into cells.

Essential Questions:
How does life result from chemical structure and function?

Concepts:

- Cells function as microscopic chemical factories synthesizing and degrading biological molecules necessary for life.
- Cells are composed mostly of: C, H, N, O, P, and S.
- Biological molecules produced by a cell can be used by the cell or transported outside for use by other cells.

Competencies:

- Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.

Big Idea #4: Cells have organized structures and systems necessary to support chemical reactions needed to maintain the living condition.

Essential Questions:
How does life result from cellular structure and function?

Concepts:

- Cells come only from the division of a pre-existing cell.
- A cell's interior is separated or compartmentalized from the environment by a phospholipid bilayer plasma membrane.
- Cells occur in two basic forms: Prokaryotes (Bacteria and Archaea) and Eukaryotes (all other cells).

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

- The cytoplasm contains a collection of connected, internal membranous sacs that divide the cytoplasm into functional and structural compartments or organelles.
- Structure is related to function at the cellular and organelle levels of biological organization.
- Cells are the basic unit of structure and function for all living things.

Competencies:

- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.

Big Idea #5: Eukaryotic cells can differentiate and organize making it possible for multicellularity.

Essential Questions:
What are the advantages of multicellularity?

Concepts:

- Organ systems function to meet an organism's needs.
- The simplest level of multicellular organization is a tissue.
- Organs work together as a system to perform common functions.
- Different types of cells and tissues combine to form distinct structures known as organs which perform specific functions.
- A multicellular organization enables life functions such as movement, digestion, internal circulation of nutrients, excretion of waste and reproduction to be subdivided among specialized groups of cells.

Competencies:

- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Compare and contrast the structural and functional similarities and differences among living things.

Big Idea #6: Through a variety of mechanisms organisms seek to maintain a biological balance between their internal and external environments.

Essential Questions:
How do organisms maintain a biological balance between their internal and external environments?

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

Concepts:

- Active transport of larger substances and subcellular structures occurs through endocytosis and exocytosis.
- Molecules, ions and water move in and out of the cell through a variety of mechanisms.
- Passive transport depends on the diffusion of substances with a concentration gradient moving across a membrane from an area of higher concentration to an area of lesser concentration without energy.
- Osmosis is the diffusion of water from an area of lower solute concentration (more aqueous solution) across a membrane to an area higher solute concentration (less aqueous solution).
- Both passive and facilitated diffusion move materials along a concentration gradient without energy.
- Homeostasis dynamically returns biological changes (body temperature, osmolarity, blood pressure, pH, blood glucose, etc.) to balance by modifying chemical reactions, adjusting energy transformations, and responding to environmental changes.

Competencies:

- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
- Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.
- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.

Overview:

Students will identify the three main components of the cell theory; compare and contrast prokaryotic and eukaryotic cells and provide examples of each type; identify examples of cell specialization and the formation of tissues; explain the significance of cell parts and how their structure relates to their function; and describe the mechanisms and the energy requirements that allow materials to move into and out of a cell.

Focus Questions:

- Why do cells play such an important role in an organism's survival?
- What are the similarities and differences among the variety of cells that exist?
- How are prokaryotic cells similar to eukaryotic cells? How are they different?
- What components make up a eukaryotic cell and how do their structural characteristics relate to the functions that they perform?
- How do organelles in a cell work together to maintain homeostasis in the cell?
- How do cells in a multicellular organism work together to maintain homeostasis?
- What are the mechanisms that allow materials to move into and out of the cell?

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

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Goals:

- For students to identify and master the understanding of prokaryotic and eukaryotic cell structure and function in addition to cell processes such as cell transport.

Objectives:
(Students will be able to)

1. State the three parts of the cell theory (All living things are made of cells; cells are the basic structure and function of living things; all cells come from pre-existing cells) and be able to apply each part to an example in nature (DOK 1, 4)
2. List and arrange the cellular organization of living things (cells→tissues→organs→organ systems→organism) (DOK 1)
3. Relate an example to the cellular organization of living things (DOK 2)
4. Make connections of diversity and specialization of cells to real-life examples (DOK 4)
5. Compare and contrast prokaryotic and eukaryotic cells (DOK 2)
6. List organelles found in eukaryotic cells (DOK 1)
7. Classify structural features of eukaryotic cell organelle and relate the structural features with the organelle's function (DOK 2)
8. Differentiate between the variety of cells that exist in the 3 domains of life (DOK 3)
9. Identify components of the cell membrane (DOK 1)
10. Apply knowledge of concentration gradients in order to explain the mechanisms by which materials move across the cell membrane (DOK 4)
11. Recall the energy requirements that apply to different types of cell transport (DOK 1)
12. Apply concepts learned in the cell unit when completing a formal written assessment (DOK 4)

Core Activities and Corresponding Instructional Methods: (The teacher is recommended to)

1. Ask the students to read and discuss chapter 7, sections 1 ("Life is Cellular") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
2. Review microscopy skills and the history of the cell's discovery when analyzing cell structure.
3. Use compound light microscopes to observe cells and identify organelles that may be visible.
4. Use a graphic organizer to compare and contrast prokaryotic and eukaryotic cells.
5. Ask the students to read and discuss chapter 7, sections 2 ("Cell Structure") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
6. Apply knowledge of cell structure and function in the form of an analogy such as a city or a school.
7. Ask the students to read and discuss chapter 7, sections 3 ("Cell Transport") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

8. Use a lab or demonstration to allow students to observe different types of cell transport. For example, allow them to pour food coloring into water one drop at a time or mix Kool Aid into water to demonstrate simple diffusion. (Other examples include the "Egg Diffusion Lab,"* "Starch/Iodine Lab,"* Cucumber/Salt Lab"*)
9. Ask the students to read and discuss chapter 7, sections 4 ("Homeostasis and Cells") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
10. To better understand cell diversity and differentiation, ask students to choose a type of cell and research its properties.* This could be used as the Marking Period 2 project.

Assessments:

Diagnostic:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Pre-assessment Resources
    - Open response questions ("Label the parts of a cell using your prior knowledge;" "What's the difference between a prokaryotic cell and a eukaryotic cell?")
    - Vocabulary Assessment(s) of prior knowledge

Formative:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Chapter 7 worksheets
- Teacher-generated assignments
- Laboratory demonstrations or experiments
- Graphic Organizers
- Activities and Review Games
- Common Assessment
- Cell diversity and differentiation project*

Summative:

- Chapter Quizzes
- Unit Test – Chapter 7

Extensions:

- 3-dimensional cell model
- Interactive Activities on Websites*
- Video Resources

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

Correctives:

- Reread Chapter 7 in *Biology* and complete quizzes at end of each chapter - Chapter Worksheets
- Give students supplemental vocabulary review materials
- Give students web-based resources that reinforce the material presented in class
- Reteach and retest important concepts including mandatory vocabulary

Materials and Resources:

- Primary Textbook - see chapters and sections within Core Activities
- Supplemental readings
- Supplemental assignments and activities
- *Study Island*
- SAS Website
- Internet Resources*

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

DELAWARE VALLEY SCHOOL DISTRICT

Curriculum Plan

Unit 4: Bioenergetics: Photosynthesis and Cell Respiration

Time Range in Days: Approximately 20 days

Standards:
PA Academic Standards
PACCS Reading and Writing for Science and Technology

Anchor(s): Biology Keystone Anchors
BIO.A.2.2.2, BIO. A. 2. 3.1, BIO.A.2.3.2, BIO.A.3.1.1, BIO.A.3.2.1, BIO.A.3.2.2.

Standards Addressed:
3.1.B.A9, 3.1.B.B6., 3.1.B.C4., 4.1.10.F., 4.2.10.D., 4.4.10.E., 3.1.10.A2, 3.1B.A2.,

Anchors:
S11.A.3.2.1, S11.A.3.2.2, S11.A.3.2.3 S11.A.1.3.2, S11.C.2.1.2

Big Idea # 1: Organisms obtain and use energy to carry out their life processes.

Essential Questions:
How do different organisms obtain and use energy to survive in their environment?

Concepts:

- How do different organisms obtain and use energy to survive in their environment?
- Most biochemical reactions require an input of energy.
- The energy flow of biochemical reactions is governed by the physical laws of thermodynamics.
- ATP molecules store usable chemical energy to drive life processes through coupled reactions.
- Photosynthesis is the process that transforms light energy into potential chemical energy.
- Cellular respiration is the process by which potential chemical energy in the bonds of glucose is transformed into potential chemical energy in the bonds of ATP.
- Forms of energy are required to maintain life.
- Glycolysis is the foundation of both aerobic and anaerobic respiration. Glycolysis, through anaerobic respiration, is the main energy source in many prokaryotes.

Competencies:

- Describe the flow of energy through living systems.

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.

Big Idea #2: Organisms on Earth interact and depend in a variety of ways on other living and nonliving things in their environments.

Essential Questions:
How do organisms interact and depend on each other and their environment for survival?

Concepts:
- Energy is converted from one form to another as it moves through a food chains and food webs.
- Organisms and their environment are interdependent.
- All forms of life on Earth are connected in a Biosphere.
- Sunlight is the initial energy source for most life on Earth.

Competencies:
- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Describe the flow of energy through living systems.
- Compare and contrast the structural and functional similarities and differences among living things.

Big Idea #3: Organisms share common characteristics of life.

Essential Questions:
How do we know if something is alive?

Concepts:
- Organisms obtain and use energy through photosynthesis or cellular respiration to carry out their life processes.

Competencies:
- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.

Overview:
Students will work to gain the understanding that photosynthesis and cell respiration are examples of cell processes that transfer energy through an ecosystem. Students will distinguish between the reactants and products of each process and be able to identify the cell structures that are responsible for carrying out the processes. Moreover, students will describe the

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

relationship that exists between photosynthesis and cell respiration for the overall success of an ecosystem.

Focus Questions:

- How do the processes of photosynthesis and cell respiration relate to cells?
- What are the reactants and products of photosynthesis?
- Do all cells undergo both photosynthesis and cell respiration?
- What organelles are responsible for carrying out photosynthesis and cell respiration?
- What are the reactants and products of cell respiration?
- What is the difference between aerobic and anaerobic cell respiration?
- How is energy transformed during each process?

Goals:

For students to be able to recognize photosynthesis and cell respiration as patterns in nature that influence the success of an ecosystem. Students will cite evidence for the energy transformation that occurs during each process, as well as understand the relationship that occurs between the processes.

Objectives:

(Students will be able to)

1. Recognize that light and pigments are necessary components of photosynthesis (DOK 1)
2. Identify and explain the role of electron carrier molecules in photosynthesis (DOK 1, 3)
3. Write the chemical equation for photosynthesis, including both reactants and products (DOK 1)
4. Distinguish between the light-dependent reactions and the light-independent reactions in photosynthesis (DOK 2)
5. Identify and be able to draw the general structure of a chloroplast (DOK 1)
6. Compare the different factors that affect the rate at which photosynthesis (DOK 3)
7. Identify patterns by which organisms obtain energy needed for life processes (DOK 2)
8. Label a cross-section of a leaf and be able to distinguish which tissues are involved in photosynthesis (DOK 1, 2)
9. Explain the general purpose of cell respiration (DOK 1)
10. Write the chemical equation for cellular respiration, including reactants and products (DOK 1)
11. Identify and be able to draw the general structure of a mitochondrion (DOK 1)
12. Recognize what happens during glycolysis (DOK 1)
13. Summarize what happens during the Krebs cycle (DOK 2)
14. Recognize how high-energy electrons are used by the electron transport chain (DOK 1)
15. Compare and contrast aerobic and anaerobic respiration (DOK 2)
16. Describe different types of anaerobic respiration (alcohol fermentation and lactic acid fermentation) (DOK 1)
17. Analyze the net production of ATP that is generated by both anaerobic and aerobic respiration (DOK 4)

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

18. Assess the relationship that exists in ecosystems between the processes of photosynthesis and cellular respiration (DOK 3)
19. Identify which types of cells undergo photosynthesis and cell respiration (DOK 1)
20. Apply prior understanding of autotrophs and heterotrophs to the processes of photosynthesis and cell respiration (DOK 4)
21. Connect prior knowledge of enzymatic reactions and how they affect chemical reactions (DOK 4)
22. Apply concepts learned when studying biochemistry to the transformations that occur between molecules in photosynthesis and cellular respiration (DOK 4)

Core Activities and Corresponding Instructional Methods: (The teacher is recommended to)
Assessments:

1. Ask the students to read and discuss chapter 8 ("Photosynthesis") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
2. Discuss different forms of energy (solar/chemical/ATP) and review characteristics of living things (heterotrophs vs. autotrophs)
3. Use a graphic organizer to allow students to better understand the overall process of photosynthesis—particularly the components that are needed for the reaction to work effectively and the major products that result at the end of the process.
4. Show a video or animation of photosynthesis or have students sketch the reactions.
5. Use a word sort* that consists of chemical formulas and symbols that challenges students to correctly arrange the reactants and products for the photosynthesis chemical equation.
6. Ask the students to read and discuss chapter 9 ("Cellular Respiration and Fermentation") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
7. Use a graphic organizer to allow students to better understand the overall process of cellular respiration—particularly the components that are needed for the reaction to work effectively and the major products that result at the end of the process.
8. Show a video or animation of cellular respiration.
9. Perform a lab experiment to show the effects of exercise on carbon dioxide production ("BTB Lab")
10. Use a word sort* that consists of chemical formulas and symbols that challenges students to correctly arrange the reactants and products for the cellular respiration chemical equation.

Assessments:

Diagnostic:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

- Pre-assessment Resources
    - Open response questions ("How do we obtain oxygen? Why are most plants green? Why do we need oxygen to stay alive?")

Formative:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Chapters 8 and 9 worksheets
- Word sorts for chemical reactions
- Teacher-generated assignments
- Graphic Organizers*
- Activities and Review Games
- Common Assessment

Summative:

- Chapter 8 Test
- Chapter 9 Test

Extensions:

- Perform an experiment that proves that plants release oxygen during the process of photosynthesis
- Perform a lab to observe the fermentation process
- Watch the TED-Ed video featuring David Blaine holding breath for 17 minutes
- Watch a video or read an article about animals who eat fermented fruit in the wild and the effects that the fruits have on the animals' behavior
- Watch a video or read an article about auto-brewery syndrome
- Textbook reading – "Should Creatine Supplements be Regulated?"*
- Interactive Activities on Websites

Correctives:

- Reread chapters 8 and 9 in *Biology* and complete quizzes at end of each chapter - Chapter Worksheets
- Give students supplemental vocabulary review materials
- Give students web-based resources that reinforce the material presented in class
- Reteach and retest important concepts including mandatory vocabulary

Materials and Resources:

- Primary Textbook - see chapters and sections within Core Activities
- Supplemental readings
- Supplemental assignments and activities (See Appendix)
- *Study Island*
- SAS Website

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

- Internet Resources*

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

DELAWARE VALLEY SCHOOL DISTRICT

Curriculum Plan

Unit 5: DNA Structure, Replication, Transcription, and Translation

Time Range in Days: Approximately 10 - 15 days

Standards:
PA Academic Standards
PACCS Reading and Writing for Science and Technology

Anchor(s): Biology Keystone Anchors
BIO.A.1.2.2, BIO.B.1.2.1, BIO.B.1.2.2, BIO.B.2.2.1, BIO.B.2.2.2, BIO.A.4.1.3

Standards Addressed:
3.1.B.A9, 3.1.B.B6., 3.1.B.C4., 4.1.10.F., 4.2.10.D., 4.4.10.E., 3.1.10.B3., 3.1.10.C2., 3.1.B.A6. 3.1.B.B1., 3.1.B.B3., 3.1.B.B5, 3.1.10.B1, 3.1.10.B5, 3.1.10.B4, 4.4.10.C, 4.4.10.D

Anchors:
S11.A.2.1, S11.B.1.1, S11.B.2.2

Big Idea # 1: Organisms share common characteristics of life.

Essential Questions:

How do we know if something is alive?

Concepts:

- Organisms can reproduce their own kind using DNA.
- Organisms grow, develop and eventually die.

Competencies:

- Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.

Big Idea # 2: New cells arise from the division of pre-existing cells.

Essential Questions:

How do cells grow and reproduce?

Concepts:

- Cell differentiation occurs many times during development of a multicellular organisms giving rise to a diversity of cell types.

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

- Cells grow when they can take in more nutrients through their plasma membranes than they can metabolize in their interior. Cells may divide when their metabolism exceeds nutrient absorption.

Competencies:

- Describe the role of DNA in protein synthesis, reproduction and evolution.

Big Idea #3: DNA segments contain information for the production of proteins necessary for growth and function of cells.

Essential Questions:
Why is DNA called the "blueprint of life"?

Concepts:

- Many synthesized polypeptides require additional processing to acquire their active, three-dimensional structures.
- Enzymes are special proteins designed to catalyze most biochemical reactions that otherwise would not occur.
- DNA contains the complete set of instructions, the genetic code, for building and running an organism.
- RNA is necessary for protein synthesis from DNA.
- The basic molecular and the associated genetic code structure of DNA are universal, revolutionizing our understanding of disease, heredity and evolution.
- Which genes are expressed at a given time is determined by the integration of internal and environmental signals received by a cell.

Competencies:

- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
- Describe the role of DNA in protein synthesis, reproduction and evolution.
- Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.

Overview:
Students will be exposed to a greater analysis of nucleic acids (first presented in Unit 2) by studying the structural and functional characteristics of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). Students will learn about the mechanisms of DNA replication; DNA transcription and the formation of RNA; and the role of DNA and RNA in protein synthesis (translation). Students will also relate the molecular structure of DNA to its vital role in heredity, gene expression, genetic mutations, and biotechnology.

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

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Focus Questions:

- What are the subunits of DNA called?
- What are the 3 main parts of those subunits?
- Why is the replication of DNA considered to be semiconservative?
- What is similar about DNA and RNA? What is different?
- What are the 3 types of RNA and why are they so important?
- What is the mechanism by which DNA forms mRNA?
- What are the subunits of proteins called?
- How do DNA and RNA play an important role in the production of proteins?
- What types of mutations can sometimes occur in an organism's DNA?
- What determines the expression of genes?
- What organelles participate in protein synthesis and transport?
- What is gene splicing?

Goals:

For students to gain a clear understanding of the structure and function of DNA and RNA and how these molecules work within the cell to create proteins that control inheritable traits. Students will later apply that understanding to cellular division, genetic variation among organisms, and patterns of inheritance.

Objectives:

(Students will be able to)

1. Identify the role of DNA in heredity (DOK 1)
2. Recall that nucleotides are the molecular subunits of DNA discussed in chapter 2 (DOK 1)
3. Label a subunit in DNA (DOK 1)
4. Illustrate the double helix structure of DNA (DOK 1)
5. Summarize the events in DNA replication, including the enzymatic activity (DOK 2)
6. Identify DNA replication as a repeating pattern that occurs in an organism's lifetime (DOK 2)
7. Recognize that mutations may occur during DNA replication and may or may not have observable effects (DOK 2)
8. Compare DNA in prokaryotes with that of eukaryotes (DOK 2)
9. Compare and contrast the structure of DNA to that of RNA (DOK 2)
10. List the 3 types of RNA (DOK 1)
11. Explain why DNA must make mRNA in order to successfully produce proteins (DOK 1)
12. Summarize the process of transcription, including the enzymatic activity (DOK 2)
13. Recall that amino acids are the subunits of proteins (DOK 1)
14. Make connections to show how mRNA codons, that were transcribed from a DNA blueprint, are then translated into a code of amino acids (DOK 4)
15. Summarize the process of protein synthesis (translation), including the role of DNA, mRNA, tRNA, and rRNA (DOK 2)

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

16. Differentiate between types of genetic mutations (DOK 3)
17. Create an analogy for the process of protein synthesis (DOK 4)
18. Connect examples of biotechnology and genetic engineering to their understanding of the principles of DNA (DOK 4)

Core Activities and Corresponding Instructional Methods: (The teacher is recommended to)
Assessments:

1. Have the students recall prior information about DNA using a graphic organizer or some type of review activity.
2. Ask students to read and discuss chapter 12, section 1 ("Identifying the Substance of Genes") to understand the role that bacteria and viruses played in the transformation of hereditary material.
3. Ask the students to read and discuss chapter 12, section 2 ("The structure of DNA") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
4. Have students watch a guided video featuring DNA structure and function such as PBS NOVA's "DNA: The Secret of Life."
5. Have the students create, draw, or color a model of the DNA double helix.
6. Ask the students to read and discuss chapter 12, section 3 ("DNA Replication") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
7. Have students perform a DNA extraction from a chosen source such as cheek cells, strawberries, bananas, spinach, etc.*
8. Ask the students to read and discuss all of chapter 13 ("RNA and Protein Synthesis") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
9. Create an analogy for the students about the roles of DNA, mRNA, rRNA, tRNA and the production of proteins (DNA = Captain of ship; mRNA = first mate; rRNA = the ship deck; tRNA = the crew members doing the heavy lifting).
10. Have the students create their own analogy for protein synthesis.
11. Discuss examples of gene splicing and how it can be applied to techniques such as gene therapy and genetically modified organisms.

Diagnostic:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Pre-assessment Resources
    - Open response questions ("What do you already know about DNA?")

Formative:

- Informal Questioning
- Teacher Observation

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

- Class Discussion
- At-the-Bell Questions
- Chapter 12 and 13 worksheets
- Illustrations or model of DNA
- Teacher-generated assignments
- Laboratory demonstrations – DNA extraction
- Graphic Organizers *
- Activities and Review Games
- Common Assessment

Summative:

- Chapter 12 and 13 quiz
- Unit Test – Chapters 12 and 13

Extensions:

- "DNA Double Helix" Interactive Game* (nobelprize.org)
- *The Island* (nonfiction movie about human cloning)
- Video Resources

Correctives:

- Reread Chapters 12 and 13 in *Biology* and complete quizzes at end of each chapter -Chapter Worksheets
- Give students supplemental vocabulary review materials
- Give students web-based resources that reinforce the material presented in class
- Reteach and retest important concepts including mandatory vocabulary

Materials and Resources:

- Primary Textbook - see chapters and sections within Core Activities
- Supplemental readings
- Supplemental assignments and activities (See Appendix)
- *Study Island*
- SAS Website
- Internet Resources*

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

DELAWARE VALLEY SCHOOL DISTRICT

Curriculum Plan

Unit 6: Cell Reproduction (Mitosis), Production of Sex Cells (Meiosis)

Time Range in Days: Approximately 10 - 15 days

Standards:
PA Academic Standards
PACCS Reading and Writing for Science and Technology

Anchor(s): Biology Keystone Anchors
BIO.B.1.1.1, BIO.B.1.1.2, BIO.B.1.2.1, BIO.B.2.1.2, BIO.B.2.3.1, BIO.B.2.4.1

Standards Addressed:
3.1.B.A9, 3.1.B.B6., 3.1.B.C4., 4.1.10.F., 4.2.10.D., 4.4.10.E., 3.1.10.A4., 3.1.B.A3., 3.1.B.A4., 3.1.10.B1., 3.1.10.B2., 3.1.B.B2.

Anchors:
S11.A.2.1, S11.B.1.1. S11.B.2.2

Big Idea #1: Organisms share common characteristics of life.

Essential Questions:
How do we know if something is alive?

Concepts:
- Organisms can reproduce their own kind using DNA.
- Organisms grow, develop and eventually die.

Competencies:
- Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.

Big Idea # 2: New cells arise from the division of pre-existing cells.

Essential Questions:
How do cells grow and reproduce?

Concepts:
- Prokaryotic cells divide via binary fission.
- Eukaryotic cells first divide their nucleus and then divide their cytoplasm to make new cells.

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

- All cells go through a cell cycle.

Competencies:

- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.

Big Idea #3: Eukaryotic cells can differentiate and organize making it possible for multicellularity.

Essential Questions:
What are the advantages of multicellularity?

Concepts:

- Organ systems function to meet an organism's needs.
- The simplest level of multicellular organization is a tissue.
- Organs work together as a system to perform common functions.
- Different types of cells and tissues combine to form distinct structures known as organs which perform specific functions.
- A multicellular organization enables life functions such as movement, digestion, internal circulation of nutrients, excretion of waste and reproduction to be subdivided among specialized groups of cells.

Competencies:

- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Compare and contrast the structural and functional similarities and differences among living things.

Big Idea #4: Hereditary information in genes is inherited and expressed.

Essential Questions:
How is the hereditary information in genes inherited and expressed?

Concepts:

- Sexually reproducing organisms produce gametes which transport hereditary information from one generation of organisms into another generation.
- Meiosis involves a two-step nuclear division reducing the number of chromosomes in half – producing gametes.
- During the process of meiosis genetic recombinations may occur contributing to genetic variability within a population.

Competencies:

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

- Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.

Overview:
Students will discuss the differing types of cell reproduction and division in order to gain an understanding of how organisms develop, grow, repair tissues, and reproduce. Students will learn vocabulary essential for the understanding of both mitosis and meiosis and why each process is so important for the survival of an organism and also an entire population.

Focus Questions:
- What is the difference between sexual and asexual reproduction?
- Why is mitosis important for an organism's survival?
- What are the steps involved in mitosis?
- What is the outcome of mitosis?
- Why is meiosis not only important for an organism's survival but also for the survival of an entire population?
- What are the steps involved in meiosis?
- What is the outcome of meiosis?
- How are mitosis and meiosis alike and how are they different?

Goals:
For students to be able to describe the processes of mitosis and meiosis and these processes affect the wellbeing and survival of an organism.

Objectives:
(Students will be able to)
1. Recognize that cell size is limited because of growth, DNA overload, and surface to volume ratio (DOK 1)
2. Differentiate between asexual and sexual reproduction (DOK 3)
3. Summarize the stages of the cell cycle (DOK 2)
4. Identify different forms of DNA and how it should appear at different stages of the cell cycle (molecular, chromatin, chromosome) (DOK 1)
5. Recognize that DNA must be copied before cell division can occur (DOK 1)
6. Explain the role of DNA and chromosomes in cell division (DOK 1)
7. Differentiate between diploid and haploid cells (DOK 3)
8. Recall what happens during the four phases of mitosis (DOK 1)
9. Describe the process of cytokinesis (DOK 1)

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

10. Distinguish between cytokinesis in animal cells and in plant cells (DOK 2)
11. Cite evidence of how the cell cycle is regulated (DOK 1)
12. Distinguish between cancer cells and healthy cells (DOK 2)
13. Relate the onset of cancer to the control of the cell cycle (DOK 2)
14. Compare and contrast a somatic cell and a gamete (DOK 2)
15. Summarize the events of meiosis (DOK 2)
16. Compare and contrast meiosis and mitosis (DOK 3)
17. Explain what a karyotype is and why it is used (DOK 1)
18. Create and analyze a karyotype in order to recognize chromosomal defects that may occur during meiosis as a result of nondisjunction(DOK 4)
19. Apply an understanding of cells to the processes of mitosis and meiosis (DOK 4)

Core Activities and Corresponding Instructional Methods: (The teacher is recommended to)

1. Have the students brainstorm reasons for why cells are so small and the need for cell division. In doing so, have students read chapter 10, section 1 ("Cell Growth, Division, and Reproduction").
2. Ask the students to read and discuss chapter 10, section 2 ("The Process of Cell Division") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
3. Use an analogy to present the relationship between molecular DNA, chromatin, and chromosomes, and explain why it is necessary for DNA to replicate and transform before cell division.
4. Use a graphic organizer to allow students to understand the process of mitosis—have the students draw out the phases in order to fully understand what happens to the nucleus and DNA during cell division (See "Mitosis Flipbook template"*)
5. Ask the students to read and discuss chapter 10, section 3 ("Regulating the Cell Cycle") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology. Provide students with a supplemental reading to better understand cancer growth and tumors.
6. Ask the students to read chapter 10, section 4 ("Cell Differentiation") and discuss common misconceptions about stem cells and their development. Provide students with supplemental readings or videos (Ex. "The Skin Gun" - *National Geographic*)
7. Ask the students to read and discuss chapter 11, section 4 ("Meiosis") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
8. Use a graphic organizer to allow students to understand the process of meiosis and how it is similar and different from mitosis—have the students draw out the phases in order to recognize that meiosis occurs in two phases and produces four cells, or gametes, that are all genetically different (See "Meiosis Flipbook template"*)
9. Have students watch Frank Gregorio's *"Meiosis: Continuation of Life"* (available on YouTube) with the video script provided and ask them to complete an assessment to follow.
10. Ask the students to read and discuss chapter 14, pages 392 – 393, to obtain an understanding of karyotyping.

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

11. Have the students create or analyze a karyotype.

Assessments:

Diagnostic:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Pre-assessment Resources
    - Open response questions ("Why are cells so small? Why do cells need to reproduce")
    - Brainstorming Activity

Formative:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Chapter 10 and 11.4 worksheets
- Student drawings of mitosis and meiosis
- Karyotyping activity
- Teacher-generated assignments
- Graphic Organizers
- Common Assessment

Summative:

- Chapter Quizzes
- Unit Test – Chapters 10 and 11.4

Extensions:

- Current event article about mitosis and cancer
- Candy ("Pull-n-Peel") Activity*
- Interactive Activities on Websites
- Video Resources

Correctives:

- Reread Chapters 10 and 11.4 in *Biology* and complete quizzes at end of each chapter -Chapter Worksheets
- Give students supplemental vocabulary review materials
- Give students web-based resources that reinforce the material presented in class
- Reteach and retest important concepts including mandatory vocabulary

Materials and Resources:

- Primary Textbook – see chapters and sections from Core Activities

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

- Supplemental readings
- Supplemental assignments and activities
- *Study Island*
- SAS Website
- Internet Resources*

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

DELAWARE VALLEY SCHOOL DISTRICT

Curriculum Plan

Unit 7: Mendelian Genetics and Biotechnology

Time Range in Days: Approximately 10-15 days

Standards:
PA Academic Standards
PACCS Reading and Writing for Science and Technology

Anchor(s): Biology Keystone Anchors
BIO.B.2.2.1, BIO.B.1.2.2, BIO.B.2.4

Standards Addressed:
3.1.B.A9, 3.1.B.B6., 3.1.B.C4., 4.1.10.F., 4.2.10.D., 4.4.10.E., 3.1.10.B3., 3.1.10.C2., 3.1.B.A6. 3.1.B.B1., 3.1.B.B3., 3.1.B.B5, 3.1.10.B1, 3.1.10.B5, 3.1.10.B4, 4.4.10.C, 4.4.10.D

Anchors:
S11.A.2.1, S11.B.1.1, S11.B.2.2

Big Idea # 1: Organisms share common characteristics of life.

Essential Questions:

How do we know if something is alive?

Concepts:

- Organisms can reproduce their own kind using DNA.
- Organisms grow, develop and eventually die.

Competencies:

- Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.

Big Idea # 2: New cells arise from the division of pre-existing cells.

Essential Questions:

How do cells grow and reproduce?

Concepts:

- Cell differentiation occurs many times during development of a multicellular organisms giving rise to a diversity of cell types.

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

- Cells grow when they can take in more nutrients through their plasma membranes than they can metabolize in their interior. Cells may divide when their metabolism exceeds nutrient absorption.

Competencies:

- Describe the role of DNA in protein synthesis, reproduction and evolution.

Big Idea #3: Hereditary information in genes is inherited and expressed.

Essential Questions:
How is the hereditary information in genes inherited and expressed?

Concepts:

- Sexually reproducing organisms produce gametes which transport hereditary information from one generation of organisms into another generation.
- Patterns of inheritance reflecting how genes interact and express themselves (including dominant, recessive, codominance, incomplete dominance, sex-linked, sex-influenced, multiple alleles) can be predicted, observed and described.
- The Punnett square is a tool that can be used to predict the probability of an offspring's genotype and phenotype.
- One or more pairs of genes on one or more chromosomes code for the expression of inherited traits.
- Two or more versions of a gene (alleles) contribute to the expression of inherited traits.

Competencies:

- Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
- Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.

Big Idea #4: DNA segments contain information for the production of proteins necessary for growth and function of cells.

Essential Questions:
Why is DNA called the "blueprint of life"?

Concepts:

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

- Many synthesized polypeptides require additional processing to acquire their active, three-dimensional structures.
- Enzymes are special proteins designed to catalyze most biochemical reactions that otherwise would not occur.
- DNA contains the complete set of instructions, the genetic code, for building and running an organism.
- RNA is necessary for protein synthesis from DNA.
- The basic molecular and the associated genetic code structure of DNA are universal, revolutionizing our understanding of disease, heredity and evolution.
- Which genes are expressed at a given time is determined by the integration of internal and environmental signals received by a cell.

Competencies:

- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
- Describe the role of DNA in protein synthesis, reproduction and evolution.
- Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.

Overview:

Students will apply their understanding of DNA and its role in heredity. They will analyze Mendelian patterns of inheritance and become acclimated with predicting genetic crosses through the use of tools such as Punnett Squares and Pedigree Charts. Lastly, students will site evidence of selective breeding and recombinant DNA technology and how it applies to the study of genetics – including the ethics of biotechnology.

Focus Questions:

- How does DNA play an important role in heredity?
- What determines the expression of genes?
- How are traits passed down from a parent generation to an offspring generation?
- How does genetic variation occur?
- How did Gregor Mendel influence the current understanding of genetics and evolution?
- What is a Punnett Square and how can it predict the probable outcome of a cross between two parents?
- What impacts does the environment have on gene expression?
- How can inheritance patterns be analyzed using a Pedigree Chart?
- What is the ABO blood typing system and how does it apply to the study of genetics?
- What is selective breeding?
- How has the study of genetics influenced other fields like forensics and bioengineering?

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

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Goals:
For students to apply their understanding of the structure and function of DNA to the patterns of inheritance that are displayed according to Gregor Mendel's Laws. Students will also study human heredity to recognize variation among individuals in a population.

Objectives:
(Students will be able to)

1. Apply concepts from DNA studies to the understanding of heredity (DOK 4)
2. Describe Gregor Mendel's studies and conclusions about inheritance (DOK 1)
3. Recall what happens during segregation in meiosis (DOK 1)
4. Recognize patterns of inheritance of human traits (DOK 1)
5. Display how geneticists use the principles of probability to predict genetic crosses by setting up and analyzing Punnett Squares (DOK 2, 4)
6. Recall the principle of independent assortment as it applies to meiosis (DOK 1)
7. Explain how Mendel's principles apply to all organisms (DOK 1)
8. Define codominance and apply the ABO blood typing system as a model of codominance (DOK 1, 4)
9. Show the cause and effect relationship between gene expression and the environment (DOK 2)
10. Analyze a pedigree chart to better understand how geneticists can study inheritance patterns (DOK 4)
11. Cite evidence for the causes of genetic disorders—distinguish between small changes in DNA; errors occurring in meiosis; and chromosomal abnormalities (DOK 2, 3)
12. Identify examples of biotechnology and genetic engineering (DOK 1)
13. Critique examples of modern biotechnology practices (DOK 3)

Core Activities and Corresponding Instructional Methods: (The teacher is recommended to)
Assessments:

1. Ask the students to read and discuss chapter 11, sections 1, 2, and 3 ("The Work of Gregor Mendel," "Applying Mendel's Principles," "Other Patterns of Inheritance") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
2. Provide students with several opportunities to practice using Punnett Squares to predict genetic crosses—the level of difficulty should increase over time (ex. Monohybrid vs. dihybrid; heterozygous crosses)
3. Have students read or watch a video about the ABO blood typing system and how it applies to multiple alleles and codominance. Use a graphic organizer to highlight the way in which the ABO alleles are expressed (see chapter 14, page 394).
4. Ask students to solve Punnett Squares using the proper ABO blood typing alleles.
5. Perform a blood simulation lab to demonstrate the ABO blood typing system and the inability to mix different types of blood together.
6. Have the students analyze Pedigree Charts to learn how geneticists can predict inheritance patterns in families (see chapter 14, pages 396 and 397).

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

7. Provide supplemental readings or have students research their own articles on varying issues in biotechnology and how it has impacted the fields of medicine, forensics, and agriculture. Ask the students to write a journal summary or reflection about the topic and lead a class discussion. (Refer to chapter 15 for information regarding biotechnology including recombinant DNA, gene splicing, and other applications of genetic engineering.
8. Have the students research a genetic disorder and present it to the class in a specific way (see variations*).

Diagnostic:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Pre-assessment Resources
    - Open response questions ("What do you already know about genetics? Why do offspring sometimes look or act like their parents?")

Formative:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Chapter 11 and 14 worksheets
- Practice problems using Punnett Squares
- Teacher-generated assignments
- Laboratory demonstrations –ABO blood typing
- Graphic Organizers *
- Activities and Review Games
- Human Genetic Disorder Project* (variations occur)
- Common Assessment

Summative:

- Chapter 11 vocabulary quiz (optional)
- Unit Test – Chapters 11 (small amount of 14 and 15)

Extensions:

- "Harry Potter Genetics" PowerPoint Activity*
- "DNA Double Helix" Interactive Game*
- *The Island* (nonfiction movie about human cloning)
- Video Resources

Correctives:

- Reread Chapters 11 and 14 in *Biology* and complete quizzes at end of each chapter -Chapter Worksheets

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

- Give students supplemental vocabulary review materials
- Give students web-based resources that reinforce the material presented in class
- Reteach and retest important concepts including mandatory vocabulary

Materials and Resources:

- Primary Textbook – see Core Activities for sections and/or page numbers
- Supplemental readings
- Supplemental assignments and activities (See Appendix)
- *Study Island*
- SAS Website
- Internet Resources*

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

DELAWARE VALLEY SCHOOL DISTRICT

Curriculum Plan

Unit 8: Evolution

Time Range in Days: Approximately 20 days

Standards:
PA Academic Standards
PACCS Reading and Writing for Science and Technology

Anchor(s): Biology Keystone Anchors
BIO.B.3.1.1, BIO.B.3.1.2, BIO.B.3.1.3, BIO.B.3.2.1, BIO.B.3.3.1

Standards Addressed:
3.1.B.A9, 3.1.B.B6., 3.1.B.C4., 4.1.10.F., 4.2.10.D., 4.4.10.E., 3.1.10.C1., 3.1.10.C3., 3.1.B.A1., 3.1.B.C1. , 3.1.B.C2., 3.1.B.C3.

Anchors:
S11.A.1.1, S.11.A.2.1, S11.B.2.2

Big Idea # 1: Evolution is the result of many random processes selecting for the survival and reproduction of a population.

Essential Questions:
How do we scientifically explain the evidence and mechanisms for biological evolution?

Concepts:

- Selective breeding and biotechnology contribute to the deliberate changing of the genetic makeup of a population.
- The differential reproductive success of populations of organisms with advantageous traits is known as natural selection.
- Common anatomical and/or genetic structures and behaviors demonstrate that species have evolved from common ancestors.
- There are similarities and differences between fossils and living organisms.
- Speciation occurs when one population is isolated from another population. The isolation can be geological, reproductive, or filling different ecological niches to reduce competition. With isolation comes changing environmental factors exerting selective pressure on mutations and adaptions.
- Mutations alter a gene's genetic information, resulting in a change in the protein that is made, or how or when a cell makes that protein. Most mutations are evolutionary neutral.
- Evolution occurs when the gene frequency of alleles in a population shifts to confer survival and reproductive success.

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

- The fossil record documents patterns of mass and background extinctions and the appearance of new species.

Competencies:

- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
- Describe the role of DNA in protein synthesis, reproduction and evolution.
- Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief

Overview:

In this unit, students will learn that evolution is considered to be one of the foundations of biology and is a scientific explanation for the diversity of life on Earth. Students will read about and discuss historical events that have occurred to shape the current scientific principles of evolution and how it applies to species diversity; population changes; advancements in medicine; extinction of populations; selective breeding; and more. Three main ideas will be addressed: 1. Evolution is the process by which the diversity of life on earth developed over time from common ancestors 2. Over time, the genetic makeup of a population changes, resulting in changes in the distribution of characteristics in that population 3. These changes result in differences within species (microevolution) as well as the emergence of new species (macroevolution).

Focus Questions:

- What is evolution?
- What mechanisms cause species to change over time?
- How does genetics play a role in evolution?
- Why are there so many diverse species on Earth?
- Who were some key historical figures that helped pave the way for the scientific community's current viewpoints on evolution?
- Who was Charles Darwin and what did he contribute to the study of evolution?
- What evidence supports the idea that organisms that currently live on Earth today share characteristics of organisms that once lived on Earth and therefore must have evolved from a common ancestor?
- What evidence supports the idea that evolution is still occurring?
- What factors contribute to a change in a population's gene pool?
- What is an adaptation?
- What is natural selection?
- What is artificial selection?

Goals:

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

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For students to define evolution as a central theme in biology that focuses on evidence of change in a population over time. Students will distinguish between large changes in a population that may give rise to a new species versus small changes in a population that will alter the appearance or adaptations of individuals in the population, without forming a new species. Furthermore, students will focus on highlighting the figureheads in biological history who contributed to the present day thoughts on evolutionary theories.

Objectives:
(Students will be able to)

1. Define evolution (DOK 1)
2. Summarize Charles Darwin's journey on the *HMS Beagle* (DOK 2)
3. Explain Darwin's theory of natural selection and how it has affected changes in populations over time, or how it may affect future changes in populations (DOK 3)
4. Identify the patterns of biodiversity that were observed by Darwin (DOK 2)
5. Distinguish between the conclusions drawn by James Hutton and Charles Lyell about the Earth's history (DOK 2)
6. Compare Jean-Baptiste Lamarck's hypothesis of evolution with that of Darwin's (DOK 2)
7. Report on Thomas Malthus' view of human population growth (DOK 1)
8. Differentiate between the research of Hutton, Lyell, Lamarck, Malthus, and Wallace and cite evidence of how it influenced Darwin's research (DOK 3)
9. Explain the role of inherited variation in artificial selection (DOK 1)
10. Identify the conditions under which natural selection occur (DOK 1)
11. Cite evidence of adaptions in nature (DOK 3)
12. Describe how an organism's fitness can affect its ability to survive (DOK 2)
13. Explain the principle of common descent (DOK 1)
14. Compare how geologic distribution of species relates to their evolutionary history (DOK 2)
15. Explain how fossils and the fossil record provide evidence of the descent of modern species from ancient ancestors (DOK 1)
16. Draw conclusions of what homologous structures, analogous structures, vestigial structures, and embryology suggest about the process of evolutionary change (DOK 3)
17. Apply the idea that DNA is molecular evidence that can be used to trace the process of evolution (DOK 4)
18. Describe how genetics plays a role in evolutionary change (DOK 1)
19. Make connections about mutations and genetic variation in a population (DOK 4)
20. Identify ways in which genetic recombination in sexual reproduction plays a role in evolution (DOK 1)
21. Describe genetic drift (DOK 1)
22. Describe genetic equilibrium and state what types of factors may affect it (DOK 1)
23. Identify the types of isolation that can lead to the formation of new species (DOK 1)
24. Summarize the processes that influenced survival or extinction of a species (DOK 2)
25. Identify some of the hypotheses about early Earth and the origin of life (DOK 1)
26. Explain the endosymbiotic theory for the evolution of eukaryotes from prokaryotes (DOK 1)

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

Core Activities and Corresponding Instructional Methods: (The teacher is recommended to)
Assessments:

1. Ask the students to brainstorm what they already know about evolution and Charles Darwin.
2. Ask the students to read and discuss all of chapter 16 ("Darwin's Theory of Evolution") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
3. Use an activity that challenges students to accomplish a task using various adaptations (For example: Darwin's finches simulation activity)
4. Refer to the timeline on page 459 to have the class create a visual representation that can be displayed and discussed throughout chapter 16.
5. Use a classroom map or individual paper maps to allow students to trace out Darwin's journey on the *Beagle* and important things that he observed along the way.
6. Ask the students to read and discuss chapter 17, sections 1, 2, and 3 ("Genes and Variation," "Evolution as Genetic Change in Populations," "The Process of Speciation") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
7. Use the *Discovery Channel "*Life*"* series to display examples of adaptations in organisms.
8. Use *National Geographic's* "The Science of Dogs" to recall prior knowledge of artificial selection and its influence on a population.
9. Use segments from *PBS NOVA's* "What Darwin Never Knew" to highlight important contributions made by Darwin and how his way of thinking was modified by modern genetics.

Assessments:
Diagnostic:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Pre-assessment Resources
    - Brainstorming activity ("What do you know about evolution? Charles Darwin?")
    - Picture sort *

Formative:

- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Chapter 16 and 17 worksheets
- Teacher-generated assignments
- Graphic Organizers (See Appendix)

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

- Activities and Review Games
- Common Assessment
- Adaptations Activity
- Video assessment worksheets

Summative:

- Unit Test – Chapters 16 and 17

Extensions:

- Natural Selection simulation: Peppered Moth*
- Guided Reading – *On the Origin of Species*
- "Darwin's Darkest Hour" (video available through YouTube)

Correctives:

- Reread Chapter 16 and 17 in *Biology* and complete quizzes at end of each chapter -Chapter Worksheets
- Give students supplemental vocabulary review materials
- Give students web-based resources that reinforce the material presented in class
- Reteach and retest important concepts including mandatory vocabulary.

Materials and Resources:

- Primary Textbook – see Core activities for chapters and sections
- Supplemental readings
- Supplemental assignments and activities (See Appendix)
- *Study Island*
- SAS Website
- Internet Resources*

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

DELAWARE VALLEY SCHOOL DISTRICT

Curriculum Plan

Unit 9: Classification

Time Range in Days: Approximately 25 days

Standards:
PA Academic Standards
PACCS Reading and Writing for Science and Technology

Anchor(s): Biology Keystone Anchors
BIO.B.3.1.1, BIO.B.3.2.1, BIO.B.3.3.1

Standards Addressed:
3.1.B.A9, 3.1.B.B6., 3.1.B.C4., 4.1.10.F., 4.2.10.D., 4.4.10.E., 3.1.10.A3., 3.1.10.A6., 3.1.10.A8., 3.1.B.A1., 3.1.B.A4

Anchors:
S11.A.1.3, S11.A.3.3, S11.B.1.1, S11.B.3.1, S11.B.3.2

Big Idea # 1: All organisms on Earth are classified based on a well-defined system of criteria and evolutionary characteristics.

Essential Questions:

- What is the goal of biologists who classify living things?
- What characteristics determine which grouping an organism should be placed into?
- How do evolutionary relationships affect the way scientists classify organisms?
- What are the major groups within which organisms are currently classified?

Concepts:

- Taxonomy is a system of classification that organizes all living things into specific groups.
- Organisms are named using a system of binomial nomenclature. All organisms are given a name in Latin because it is a universal language.
- Cladograms and diagrams that can be used to display the evolutionary relationships among individuals who are related.
- Dichotomous keys are utilized by taxonomists to accurately identify an organism.

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- The taxonomic order is a systemic and organized way of classifying organisms from a very large spectrum to a very small and specific spectrum.
- There are 6 major kingdoms that all organisms are classified into: Eubacteria, Archaebacteria, Protista, Animalia, Plantae, and Fungi. Each kingdom is then subdivided further into phyla, classes, order, etc.

Competencies:

- Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
- Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.

Overview:

Students have learned that all living things on Earth that have been observed have been classified based on specific set of criteria and evolutionary history. In chapter 18, students will recall the traditional classification of organisms, modern evolutionary classification, and the tree of life that highlights common descent. Students will apply information from the evolution unit to make connections that the diversity of life on Earth is the result of ongoing evolutionary change and that species alive today have evolved from ancient common ancestors.

Focus Questions:

- What criteria are used to group organisms based on similarities?
- What is taxonomy?
- How is an organism named?
- Why is it important to use a common language when naming organisms?
- What is the taxonomic order?
- What are the six major kingdoms of living things?
- What are some distinguishing features or organisms found in each kingdom?

Goals:

For students to understand the traditional Linnaean classification system and the modern evolutionary classification of living things. Moreover, students will review how to interpret a cladogram and introduce the use a dichotomous key to identify organisms. Lastly, students will take a more in depth look into the major characteristics of the six kingdoms of life.

Objectives:

(Students will be able to)

1. Describe the goals of binomial nomenclature and systematics (DOK 1)
2. Identify the taxa in the classification system devised by Linnaeus (DOK 1)
3. Compare evolutionary classification and Linnaean classification (DOK 2)
4. Interpret a cladogram (DOK 2)
5. Analyze the use of DNA sequences in classification (DOK 4)
6. Name the six kingdoms of life as they are currently identified (DOK 1)

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7. Explain what the tree of life represents (DOK 1)
8. Summarize some major characteristics of viruses (DOK 2)
9. Explain why viruses are not classified as living organisms (DOK 1)
10. Summarize some major characteristics of eubacteria (DOK 2)
11. Summarize some major characteristics of archaebacteria (DOK 2)
12. Compare and contrast eubacteria and archaebacteria (DOK 2)
13. Explain the role of bacteria in the living world (DOK 1)
14. Identify ways in which bacteria cause disease (DOK 2)
15. Identify ways in which viruses cause disease (DOK 2)
16. Summarize some major characteristics of protists (DOK 2)
17. Summarize some major characteristics of fungi (DOK 2)
18. Summarize some major characteristics of plants (DOK 2)
19. Summarize some major characteristics of animals (DOK 2)
20. Develop a logical argument that all organisms share common characteristics (DOK 3)

Core Activities and Corresponding Instructional Methods: (The teacher is recommended to)
Assessments:

1. Ask the students to read and discuss all of chapter 18 ("Classification") and present vocabulary and concepts in a way that students can use as a study tool and mastery of the main ideas and terminology.
2. Provide the students with an opportunity interpreting cladograms and using dichotomous keys for identifying organisms.
3. Refer to chapters 20 ("Viruses and Prokaryotes"), 21 ("Protists and Fungi"), 22 ("Introduction to Plants"), and 25 ("Introduction to Animals") for as a resource for information on the six kingdoms of life. Present vocabulary and concepts about each kingdom, plus viruses, in a way that students can use as a study tool and mastery of the main ideas and terminology.
4. Use the "Protist Identification Lab" as a way to allow students to practice using microscopes and identifying protists using dichotomous keys.
5. Use dissections of choice such as the flower, the earthworm, the starfish, the crayfish, and the frog dissection to allow students the opportunity investigate characteristics of organism in various phyla.

   Diagnostic:

   - Informal Questioning
   - Teacher Observation
   - Class Discussion
   - At-the-Bell Questions
   - Pre-assessment Resources
     - Open response questions ("What are your thoughts on…?")
     - Carousel Brainstorm*
     - Word Sorts *

   Formative:

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- Informal Questioning
- Teacher Observation
- Class Discussion
- At-the-Bell Questions
- Chapter 18, 20, 21, 22, 25 worksheets
- Teacher-generated assignments
- Laboratory investigation – "Protist ID Lab"*
- Graphic Organizers *
- Activities and Review Games
- Common Assessment
- Dissections*

Summative:

- Chapter Quizzes
- Unit Test

Extensions:

- "Who am I?" Activity – students read a description about an organism and have to guess what the organism is
- Virtual Dissections
- Interactive Activities on Websites *
- Video Resources*

Correctives:

- Reread Chapters 18, 20, 21, 22, and 25 in *Biology* and complete quizzes at end of each chapter -Chapter Worksheets
- Give students supplemental vocabulary review materials.
- Give students web-based resources that reinforce the material presented in class.
- Reteach and retest important concepts including mandatory vocabulary.

Materials and Resources:

- Primary Textbook
- Supplemental readings
- Supplemental assignments and activities (See Appendix)
- *Study Island*
- SAS Website
- Internet Resources (See Appendix)

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file "giordanod" in a file titled "Biology Curriculum Resources."

DELAWARE VALLEY SCHOOL DISTRICT

Primary Textbook(s) Used for this Course of Instruction

Name of Textbook: *Biology*

Textbook ISBN-13 #: 978-0-13-366951-0
ISBN-10 #: 0-13-366951-3

Textbook Publisher & Year of Publication: Pearson Education, Inc., 2010

Authors: Kenneth R. Miller and Joseph S. Levine

Curriculum Textbook is utilized in (title of course): Biology

*NOTE: Example laboratory demonstrations/experiments and/or activities that have been highlighted in the core activities or assessments can be found in public file “giordanod” in a file titled “Biology Curriculum Resources.”

Appendix

Standards

ORGANISMS AND CELLS

3.1.10.A1: Explain the characteristics of life common to all **organisms.**
3.1.10.A2: Explain cell processes in terms of chemical reactions and energy changes.
3.1.10.A3: Compare and contrast the **life cycles** of different **organisms.**
3.1.10.A4: Describe the **cell cycle** and the process and significance of **mitosis.**
3.1.10.A5: Relate life processes to sub-cellular and cellular structures to their functions.
3.1.10.A6: Identify the advantages of multi-cellularity in organisms.
3.1.10.A7: Describe the relationship between the structure of **organic molecules** and the function they serve in living **organisms.** Explain how cells store and use information to guide their functions.
3.1.10.A8: Investigate the spatial relationships of **organisms' anatomical** features using specimens, models, or computer programs.
3.1.10.A9:

- Compare and contrast scientific theories.
- Know that both direct and indirect observations are used by scientists to study the natural world and universe.
- Identify questions and concepts that guide scientific investigations.
- Formulate and revise explanations and models using logic and evidence.
- Recognize and analyze alternative explanations and models.
- Explain the importance of accuracy and precision in making valid measurements.

GENETICS

3.1.10.B1: Describe how **genetic** information is inherited and expressed.
3.1.10.B2: Explain the process of **meiosis** resulting in the formation of **gametes.** Compare and contrast the function of **mitosis** and **meiosis.**
3.1.10.B3: Describe the basic structure of **DNA** and its function in **genetic** inheritance. Describe the role of **DNA** in **protein synthesis** as it relates to **gene expression.**
3.1.10.B4: Explain how **genetic technologies** have impacted the fields of medicine, **forensics**, and agriculture.
3.1.10.B5: PATTERNS Use models to demonstrate patterns in biomacromolecules. Compare and contrast Mendelian and non-Mendelian patterns of inheritance.
3.1.10.B6:

- Compare and contrast scientific theories.
- Know that both direct and indirect observations are used by scientists to study the natural world and universe.
- Identify questions and concepts that guide scientific investigations.
- Formulate and revise explanations and models using logic and evidence.

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- Recognize and analyze alternative explanations and models.
- Explain the importance of accuracy and precision in making valid measurements.

EVOLUTION

3.1.10.C1: Explain the mechanisms of biological **evolution.**

3.1.10.C2: Explain the role of **mutations** and **gene recombination** in changing a population of **organisms.**

3.1.10.C3: CONSTANCY AND CHANGE Interpret data from fossil records, anatomy and **physiology**, and **DNA** studies relevant to the **theory of evolution.**

3.1.10.C4:

- Compare and contrast scientific theories.
- Know that both direct and indirect observations are used by scientists to study the natural world and universe.
- Identify questions and concepts that guide scientific investigations.
- Formulate and revise explanations and models using logic and evidence.
- Recognize and analyze alternative explanations and models.
- Explain the importance of accuracy and precision in making valid measurements.

CHEMISTRY

3.2.10.A1: Predict properties of **elements** using trends of the **periodic table.** Identify properties of matter that depend on sample size. Explain the unique properties of water (**polarity**, high boiling point, forms **hydrogen bonds**, high **specific heat**) that support life on Earth.

3.2.10.A2: Compare and contrast different bond types that result in the formation of molecules and compounds. Explain why **compounds** are composed of integer ratios of **elements.**

3.2.10.A3: Describe phases of matter according to the **kinetic molecular theory.**

3.2.10.A4: Describe chemical reactions in terms of atomic rearrangement and/or electron transfer. Predict the amounts of products and reactants in a chemical reaction using **mole** relationships. Explain the difference between **endothermic** and **exothermic** reactions. Identify the factors that affect the rates of reactions.

3.2.10.A5: MODELS Describe the historical development of models of the atom and how they contributed to modern atomic theory. SCALE Apply the mole concept to determine number of particles and molar mass for elements and compounds.

3.2.10.A6:

- Compare and contrast scientific theories.
- Know that both direct and indirect observations are used by scientists to study the natural world and universe.
- Identify questions and concepts that guide scientific investigations.
- Formulate and revise explanations and models using logic and evidence.
- Recognize and analyze alternative explanations and models.
- Explain the importance of accuracy and precision in making valid measurements.

PHYSICS

3.2.10.B1: Analyze the relationships among the net forces acting on a body, the **mass** of the body, and the resulting acceleration using Newton's Second Law of Motion. Apply Newton's Law of Universal Gravitation to the forces between two objects. Use Newton's Third Law to explain forces as interactions between bodies. Describe how interactions between objects conserve momentum.

3.2.10.B2: Explain how the overall energy flowing through a system remains constant. Describe the work-energy theorem. Explain the relationships between work and power.

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3.2.10.B3: Explain how heat energy will move from a higher temperature to a lower temperature until equilibrium is reached. Analyze the processes of **convection, conduction**, and **radiation** between objects or regions that are at different temperatures.
3.2.10.B4: Describe quantitatively the relationships between voltage, current, and resistance to electrical energy and power. Describe the relationship between electricity and magnetism as two aspects of a single electromagnetic force.
3.2.10.B5: Understand that waves transfer energy without transferring matter. Compare and contrast the wave nature of light and sound. Describe the components of the electromagnetic spectrum. Describe the difference between sound and light waves.
3.2.10.B6: PATTERNS SCALE MODELS CONSTANCY/ CHANGE Explain how the behavior of matter and energy follow predictable patterns that are defined by laws.
3.2.10.B7:

- Compare and contrast scientific theories.
- Know that both direct and indirect observations are used by scientists to study the natural world and universe.
- Identify questions and concepts that guide scientific investigations.
- Formulate and revise explanations and models using logic and evidence.
- Recognize and analyze alternative explanations and models

EARTH AND SPACE SCIENCES
3.3.10.A1: Relate **plate tectonics** to both slow and rapid changes in the earth's surface. Describe the **rock cycle** and the processes that are responsible for the formation of **igneous, sedimentary**, and **metamorphic** rocks. Relate **geochemical cycles** to the conservation of matter. Explain how the Earth is composed of a number of dynamic, interacting systems exchanging energy or matter.
3.3.10.A2: Analyze the effects on the environment and the **carbon cycle** of using both renewable and nonrenewable sources of energy.
3.3.10.A3: Explain how the **evolution** of Earth has been driven by interactions between the **lithosphere, hydrosphere, atmosphere,** and **biosphere.**
3.3.10.A4: Relate **geochemical cycles** to conservation of matter. Explain how the Earth's systems and its various cycles are driven by energy.
3.3.10.A5: Explain how there is only one ocean. Explain the processes of the **hydrologic cycle.** Explain the dynamics of oceanic **currents** and their relationship to global circulation within the marine environment.
3.3.10.A6: Interpret meteorological data to describe and/or predict weather. Explain the phenomena that cause global atmospheric processes such as storms, **currents**, and wind patterns.
3.3.10.A7: SCALE/MODELS Interpret and create models of the Earth's physical features in various mapping representations. CONSTANCY AND CHANGE Relate constancy and change to the hydrologic and **geochemical cycles.** SCALE Apply an appropriate scale to illustrate major events throughout **geologic time.** CONSTANCY/CHANGE Describe factors that contribute to global climate change.
3.3.10.A8:

- Compare and contrast scientific theories.
- Know that both direct and indirect observations are used by scientists to study the natural world and universe.
- Identify questions and concepts that guide scientific investigations.
- Formulate and revise explanations and models using logic and evidence.
- Recognize and analyze alternative explanations and models.
- Explain the importance of accuracy and precision in making valid measurements.

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DELAWARE VALLEY SCHOOL DISTRICT

ORIGIN AND EVOLUTION OF THE UNIVERSE

3.3.10.B1: Explain how gravity is responsible for planetary orbits. Explain what caused the sun, Earth, and most of the other planets to form between 4 and 5 billion years ago. Provide evidence to suggest the Big Bang Theory. Describe the basic **nuclear processes** involved in energy production in a star.

3.3.10.B2: SCALE AND MEASUREMENT Explain how scientists obtain information about the universe by using technology to detect **electromagnetic radiation** that is emitted, reflected, or absorbed by stars and other objects. CONSTANCY AND CHANGE Describe changes in the universe over billions of years. SCALE AND MEASUREMENT Explain the scale used to measure the sizes of stars and galaxies and the distances between them

3.3.10.B3:

- Compare and contrast scientific theories.
- Know that both direct and indirect observations are used by scientists to study the natural world and universe.
- Identify questions and concepts that guide scientific investigations.
- Formulate and revise explanations and models using logic and evidence.
- Recognize and analyze alternative explanations and models.
- Explain the importance of accuracy and precision in making valid measurements.

TECHNOLOGY AND ENGINEERING EDUCATION

3.4.10.A1: Illustrate how the development of **technologies** is often driven by profit and an economic market.

3.4.10.A2: Interpret how **systems** thinking applies logic and creativity with appropriate comprises in complex real-life problems.

3.4.10.A3: Examine how **technology** transfer occurs when a new user applies an existing **innovation** developed for one purpose in a different function.

TECHNOLOGY AND SOCIETY

3.4.10.B1: Compare and contrast how the use of **technology** involves weighing the trade-offs between the positive and negative effects.

3.4.10.B2: Demonstrate how humans devise **technologies** to reduce the negative consequences of other **technologies.**

3.4.10.B3: Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various **technologies.**

3.4.10.B4: Recognize that technological development has been evolutionary, the result of a series of refinements to a basic **invention.**

TECHNOLOGY AND ENGINEERING DESIGN

3.4.10.C1: Apply the components of the technological design process.

3.4.10.C2: Analyze a **prototype** and/or create a working model to test a design concept by making actual observations and necessary adjustments.

3.4.10.C3: Illustrate the concept that not all problems are technological and not every problem can be solved using **technology.** ABILITIES FOR A TECHNOLOGICAL WORLD

3.4.10.D1: Refine a design by using **prototypes** and modeling to ensure quality, efficiency, and productivity of a final product.

3.4.10.D2: Diagnose a malfunctioning **system** and use tools, materials, and knowledge to repair it.

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3.4.10.D3: Synthesize data, analyze trends, and draw conclusions regarding the effect of **technology** on the individual, society, and the environment.

THE DESIGNED WORLD

3.4.10.E1: Assess how medical **technologies** over time have impacted prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, and genetic engineering.
3.4.10.E2: Compare and contrast how the engineering design and management of agricultural **systems** require knowledge of artificial ecosystems and the effects of technological development on flora and fauna.
3.4.10.E3: Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others.
3.4.10.E4: Evaluate the purpose and effectiveness of information and communication **systems.**
3.4.10.E5: Analyze the development of transportation services and methods and their impact on society.
3.4.10.E6: Illustrate how manufacturing **systems** may be classified into types such as customized production, batch production, and continuous production.
3.4.10.E7: Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

Anchors

S11.A.1 REASONING AND ANALYSIS

S11.A.1.1: Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems.
S11.A.1.2: Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications.
S11.A.1.3: Describe and interpret patterns of change in natural and human-made systems.

S11.A.3: SYSTEMS, MODELS, AND PATTERNS

S11.A.3.1: Analyze the parts of a simple system, their roles, and their relationships to the system as a whole.
S11.A.3.2: Compare observations of the real world to observations of a constructed model.
S11.A.3.3: Compare and analyze repeated processes or recurring elements in patterns.

S11.B.1: STRUCTURE AND FUNCTION OF ORGANISMS

S11.B.1.1: Explain structure and function at multiple levels of organization.

S11.D.1: EARTH FEATURES AND PROCESSES THAT CHANGE EARTH AND ITS RESOURCES

S11.D.1.1: Explain and analyze the forces in the lithosphere that continually shape Earth.
S11.D.1.2: Analyze how human-made systems impact the management and distribution of natural resources.
S11.D.1.3: Explain the significance and contribution of water as a resource to living things and the shaping of the land.

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DELAWARE VALLEY SCHOOL DISTRICT

Checklist to Complete and Submit with Curriculum:

_____ A hard copy of the curriculum using The template entitled "Planned Instruction," available on the district website

_____ Hard copies of all supplemental resources not available electronically

_____ The primary textbook form(s)

_____ The appropriate payment form, in compliance with the maximum curriculum writing hours noted on the first page of this document

_____ A USB/Flash Drive containing a single file that will print the curriculum in its intended sequence from beginning to end and all supplemental resources that are available in electronic format.

Each principal and/or department chair has a schedule of First and Second Readers/Reviewers. Each Reader/Reviewer must sign & date below.

First Reader/Reviewer Printed Name_____

First Reader/Reviewer Signature_____ Date_____

Second Reader/Reviewer Printed Name_____

Second Reader/Reviewer Signature _____ Date_____

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