DCPS
SCIENCE DEPT

Biology Curriculum Guide
SY 23-24

SCIENCE THINGS

Contents

Reading the Science Curriculum Guide

Grade-Level Overview & Year-at-a-Glance

The DCPS Science Curriculum Guide begins with the **grade-level overview** and **year-at-a-glance** that names the NGSS disciplinary core ideas, the units of study, as well as the the topics and performance expectations to be covered each Term. The grouping of topics into units and sequence of those units generally matches the organization of content within STEMscopes, our core curricular resource for science. Because we are using STEMscopes structures, some of the units cross the boundary between terms. In some cases, the order of STEMscopes units has been adjusted based on feedback from DCPS teachers. In addition, each NGSS performance expectation listed is linked to a downloadable/printable PDF of the Evidence Statements from https://www.nextgenscience.org.

NGSS Evidence Statements

The **NGSS Evidence Statements** for all student performance expectations are an essential resource for planning science instruction. These statements provide additional detail on what students should know and be able to do, and include observable and measurable components that, when met, will satisfy the NGSS performance expectations.[1] These statements support teachers in unpacking the standards and determining what needs to be included in an instructional sequence. Evidence statements include the performance expectation in its entirety, including the **clarifying statements**, **assessment boundaries**, and **foundation boxes** which list the specific science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) that were combined to produce the performance expectation.

Unit Guides

Unit guides are included for each unit of study and include the following components:

- **Anchoring Phenomenon –** the phenomenon that students will make progress throughout the unit as they experience and learn a variety of new science ideas.
- **Performance Expectations (PEs)** – a summary of the standards addressed in the unit; additional detailson the performance expectations are included in the evidence statements at the end of the document.
- **Big Ideas (Disciplinary Core Ideas)** – the big ideas come directly from the disciplinary core ideas associated with the unit's performance expectations.
- **Tier 1 Instructional Activities –** includes links to curricular resources from STEMscopes with specific guidance on which components of the 5E STEMscopes lesson are recommended to address the PE and Big Idea for that topic. Tier 1 resources are arranged in accordance with the 5E model of instruction and therefore includes resources for:
    - Engage: Students are mentally engaged with an event, question, or challenge.

[1] Taken from the Achieve Next Generation Science Standards website: http://www.nextgenscience.org/resources/evidence- statements.

- Explore: Students gather information through (often) hands-on experiences with scaffolded guidance.
- Explain: Students communicate their understanding of scientific concepts by formulating generalizations, reflecting on plausibility of explanations, and/or analyzing and interpreting data.
- Elaborate: Students apply what they have learned and extend their knowledge and skills to new situations.
- Evaluate: Students assess their own knowledge and skills while teachers evaluate their progress.

  Please note: While Evaluate is listed as the last stage of the 5E model, evaluation should happen continuously throughout the lesson (e.g., exit tickets, journal writing, discussion questions, etc.).

More information about the 5E model of instruction can be found in the Appendix of this curriculum guide.

- **Tier 2 and 3 Supplemental Resources and Activities** – supplemental resources and activities are suggested from a variety of sources including Discovery Education Science Techbook (available for all students and teachers grades K-12), ExploreLearning Gizmos (available for all students and teachers grades 3-12), as well as other suggested resources – all to support Tier 2 and Tier 3 instruction. Resources to be used for acceleration are also included in this section.
- **Considerations for "Unit 0"** – It is common to begin the first week or two in any science class for introductory lessons and activities, often referred to as "Unit 0". In many schools, student schedules are in flux during the first few days or weeks of school, making it difficult to simply jump right into new course content. In addition to establishing classroom expectations and routines, students may need an introduction to the course which includes, but is not limited to, understanding the Nature of Science and revisiting the Science and Engineering Practices that they learned in previous years. Suggestions for Unit 0 resources can be found on the Science Canvas Portal.

Additional Resources to Support NGSS-aligned Planning and Classroom Implementation

The following is a list of resources to support planning and classroom implementation. This is not an exhaustive list and will be updated as needed.

1. 5E Instructional Practices document
2. Science Instruction Look-For Tool
3. NGSS site https://www.nextgenscience.org
4. EQuIP rubric and detailed guidance document
5. Task Annotation Project in Science (TAPS): https://www.nextgenscience.org/taps
6. STEM Teaching Tools: https://stemteachingtools.org/
7. Tools for Ambitious Science Teaching: https://ambitiousscienceteaching.org/
8. Teaching with Phenomena: https://www.ngssphenomena.com/teaching-with-phenomena

Biology Overview & Year-at-a-Glance

In Biology, students continue developing their understanding of disciplinary core ideas, science and engineering practices, crosscutting concepts, and engineering design to help them make sense of the life sciences. The year begins with a review of the chemistry of life, to better understand matter's relationship to living things. They then investigate the structure and function of cells as the units of life, how cells obtain and use the energy, the hierarchical systems of organisms, and the role of specialized cells. Students also explore topics of inheritance and apply this learning to evolution by natural selection. Finally, students learn about interdependent relationships in ecosystems to better answer the question of how organisms survive and thrive. The scope and sequence reorganization improves lesson flow, creates more room for teacher discretion regarding pacing, and allows more time for productive struggle and depth into topics of interest.

Term (YL)	Unit	Topics (Associated Performance Expectations)
1	Unit 1: Molecules of Life	Molecules of Life (HS-LS1-6) Cellular Energy (HS-LS1-5, HS-LS1-7) Flow of Matter and Energy in Ecosystems (HS-LS2-4) Carbon Flow in Ecosystems (HS-LS2-5)** Bioenergetics (HS-LS2-3)
2	Unit 2: Ecosystems and the Environment	Carrying Capacity (HS-LS2-1) Biodiversity and Changes in Ecosystems (HS-LS2-2, HS-LS2-6)** **Pythons RCT** Animal Behavior and Survival (HS-LS2-8) Minimizing Human Impact on Earth (HS-LS2-7, HS-LS4-6, HS-ETS1-3, HS-ETS1-4) Environmental Impacts on Species (HS-LS4-5)**
3	Unit 3: Organization of Systems and Genetics	Organization of Systems (HS-LS1-2) Feedback and Homeostasis (HS-LS1-3) ** Cell Division and Complex Organisms (HS-LS1-4) DNA to Proteins (HS-LS1-1) **CRISPR RCT** Variations in Traits (HS-LS3-2, HS-LS3-3) Inheritance of Traits (HS-LS3-1)
4	Unit 4: Evolution	Evidence of Common Ancestry (HS-LS4-1) Factors of Evolution (HS-LS4-2) Results of Natural Selection (HS-LS4-3, HS-LS4-4)

*Engineering, Technology, and Application of Science (ETS) performance expectations can be addressed at any time but are especially connected to this topic/scope.

**These scopes are now merged and intended to be taught in the same lesson sequence. These lessons may take up to 1.5 weeks depending on the learner's pace.

Reimagined Scope & Sequence for 4x4 Course Schedules: The purpose of this modification is to encourage teachers to take students outdoors for their labs and lesson activities where they can experience the lesson in context.

For teachers on the 4x4 schedule, the Semester 2 curriculum has been reorganized to be more conducive to outdoor labs and learning activities. This ensures that students can engage in outdoor explorations of investigative phenomena during the warmer months. Semester 1 will follow the same order as the full-year course. During the 2nd semester these scopes are reorganized so the ecosystem content is towards the end of the year when students can go outside to engage with the lesson sequence.

Fall 4x4 Semester 1 Course Scope & Sequence		
Term (4x4)	**Unit**	**Topics (Associated Performance Expectations)**
1	Unit 1: Molecules of Life	Molecules of Life (HS-LS1-6) Cellular Energy (HS-LS1-5, HS-LS1-7) Flow of Matter and Energy in Ecosystems (HS-LS2-4) Carbon Flow in Ecosystems (HS-LS2-5)** Bioenergetics (HS-LS2-3)
	Unit 2: Ecosystems and the Environment	Biodiversity and Changes in Ecosystems (HS-LS2-2, HS-LS2-6) **Pythons RCT** Carrying Capacity (HS-LS2-1)** Animal Behavior and Survival (HS-LS2-8) Environmental Impacts on Species (HS-LS4-5) Minimizing Human Impact on Earth (HS-LS2-7, HS-LS4-6, HS-ETS1-3, HS-ETS1-4)**
2	Unit 3: Organization of Systems and Genetics	Organization of Systems (HS-LS1-2) & Feedback and Homeostasis (HS-LS1-3)** Cell Division and Complex Organisms (HS-LS1-4) DNA to Proteins (HS-LS1-1) **CRISPR RCT** Variations in Traits (HS-LS3-2, HS-LS3-3) Inheritance of Traits (HS-LS3-1)
	Unit 4: Evolution	Evidence of Common Ancestry (HS-LS4-1) Factors of Evolution (HS-LS4-2) Results of Natural Selection (HS-LS4-3, HS-LS4-4)

Spring 4x4 Semester 2 Course Scope & Sequence		
Term (4x4)	**Unit**	**Topics (Associated Performance Expectations)**
3	**Unit 1:** Organization of Systems and Genetics	Organization of Systems (HS-LS1-2) + Feedback and Homeostasis (HS-LS1-3)** Cell Division and Complex Organisms (HS-LS1-4) DNA to Proteins (HS-LS1-1) **CRISPR RCT** Variations in Traits (HS-LS3-2, HS-LS3-3) Inheritance of Traits (HS-LS3-1)
	Unit 2: Evolution	Evidence of Common Ancestry (HS-LS4-1) Factors of Evolution (HS-LS4-2) Results of Natural Selection (HS-LS4-3, HS-LS4-4)
4	**Unit 3:** Molecules of Life	Molecules of Life (HS-LS1-6) Cellular Energy (HS-LS1-5, HS-LS1-7) Flow of Matter and Energy in Ecosystems (HS-LS2-4) Carbon Flow in Ecosystems (HS-LS2-5)** Bioenergetics (HS-LS2-3)
	Unit 4: Ecosystems and the Environment	Biodiversity and Changes in Ecosystems (HS-LS2-2, HS-LS2-6) **Pythons RCT** Carrying Capacity (HS-LS2-1)** Animal Behavior and Survival (HS-LS2-8) Environmental Impacts on Species (HS-LS4-5) Minimizing Human Impact on Earth (HS-LS2-7, HS-LS4-6, HS-ETS1-3, HS-ETS1-4)**

*Engineering, Technology, and Application of Science (ETS) performance expectations can be addressed at any time but are especially connected to this topic/scope.

**These scopes are now merged and are designed to be taught in the same lesson sequence. These lessons may take up to 1.5 weeks depending on learner pace

Unit Guide: Molecules of Life

The following unit guide provides a breakdown of Tier 1 instructional activities that should be completed for each topic, each week. Supplemental resources and activities are also provided and can be used to provide additional support for students who need Tier 2 or 3 support (i.e., remediation and/or intervention).

<table>
<tr><td colspan="4">MAP BOY: Work with testing coordinator to schedule testing (DCPS Assessments Canvas Page)</td></tr>
<tr><td colspan="4">Unit Anchoring Phenomenon: Plants and animals have always maintained a symbiotic relationship. Students consider in what ways these organisms rely on one another for energy and how their energy processes interact with one another. Students will investigate how both plants and animals create energy and how these processes are interdependent and have created a symbiotic relationship between organisms.</td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="3">HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

Big Ideas: Molecules are the building blocks of life and can be broken down into individual elements and rearranged to create new molecules to sustain life.</td></tr>
<tr><td>Weeks (YL or 4x4)</td><td>Tier 1 Instructional Activities</td><td colspan="2">Tier 2 and 3 Supplemental Resources and Activities[2]</td></tr>
<tr><td rowspan="3">Week 1 (Year-Long and 4x4)</td><td rowspan="3">SCOPE: Molecules of Life
1. Engage: Hook - You Are What You Eat (<30 mins)
2. Explore 1: Activity - Biomolecules (<45 mins)
3. Explore 2: Activity - Building Biomolecules (1-2 hrs)
3. Explain (STEMscopedia)
4. Evaluate (CER, OER, MCA)</td><td>Resources</td><td>Rationale for use</td></tr>
<tr><td>Gizmos
Dehydration Synthesis</td><td>This Gizmos activity will provide a visual representation of how molecules are constructed and how the molecules interact with one another.</td></tr>
<tr><td>STEMscopes Intervention Guided Practice</td><td>This activity can be scaffolded down to provide support.</td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="3">HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.

Big Ideas: Photosynthesis is an energy transformation process that provides plants with energy. Cellular respiration is also an energy transformation process performed by animals that juxtapose photosynthesis and supports the carbon cycle.</td></tr>
<tr><td rowspan="2">Week 2 (Year-Long)</td><td rowspan="2">SCOPE: Cellular Energy
1. Engage: Accessing Prior Knowledge - Cellular Energy</td><td>Resources</td><td>Rationale for use</td></tr>
<tr><td>NEED Resource: Energy Bingo</td><td>Energy Bingo is an alternate or additional “Engage” activity that provides a review of general energy concepts</td></tr>
</table>

[2] These suggested activities can be used, where indicated, for remediation and/or intervention. Resources to be used for acceleration are also included in this section.

Week 1 (4x4)	2. Explore 1: Inputs/Outputs Cellular Energy 3. Explore 2: Scientific Investigation - Elodea and Cellular Energy (2-4 days) 4. Explain (STEMscopedia) 5. Evaluate (CER, OER, MCA)	(Science of Energy-Secondary)	
		NEED Resource: Activity Stations (Science of Energy-Secondary)	This resource provides a review of energy concepts and provides a hands-on exploration of energy transitions. Associated text materials can be downloaded from the NEED website in intermediate and primary reading levels
		STEMScopes Inputs and Outputs: Cellular Energy (1-2 hrs)	The Inputs and Outputs: Cellular Energy support uses a graphic organizer to explain how the two cellular energy processes differ.
PE(s) and Big Ideas for this section	**HS-LS2-4.** Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. **Big Idea:** Students will be able to create models of photosynthesis in order to explain the cycling of matter in the ecosystem. They will be able to demonstrate an understanding of the concept of matter and the forms of matter. *These scopes may take up to 1.5 weeks		
Week 3 (Year-Long) Week 2 (4x4)	**SCOPE: Flow of Matter and Energy in Ecosystems** 1. Engage: Hook - Flow of Matter and Energy in Ecosystems (<45 mins) 2. Explore 1: Activity - Molecule Madness (<45 mins) 3. Explore 2: Activity - Food Chain Game (<45 mins) 4. Explore 3: Activity - Hunger Games (<45mins) 5. Explain (STEMscopedia) 6. Evaluate (CER, OER, MCA) **SCOPE: Carbon Flow in Ecosystems** 1. Engage: Hook - Carbon Flow in Ecosystems (<45 mins) 2. Explore 1: Activity - The Carbon Cycle Game (1-2 hrs) 3. Explore 2: Research: What makes the World go Round 4. Explain (STEMscopedia) 5. Evaluate (CER, OER, MCA)	**Resources**	**Rationale for use**
		Gizmos: Photosynthesis Lab or Cell Energy Cycle	The Gizmos labs will support students who are struggling to understand the mechanics of matter cycles.
		STEMScopes Flow of Matter and Energy Intervention Guided Practice	The Stemscopes resource allows students to step back and review the processes using a deconstructed mind map
		What Is Photosynthesis? Video Support	This video provides a visual explanation of photosynthesis and its importance to life on earth.

<table>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="3"><u>HS-LS2-3</u>. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

<u>Big Idea</u>: Students will be able to explain how matter and energy move via the processes of aerobic and anaerobic respiration.</td></tr>
<tr><td>Week 4
(Year-Long)

Week 3
(4X4)</td><td>SCOPE: Bioenergetics
1. Engage: Hook - Bioenergetics (<30 mins)
2. Explore 1: Activity - Let it Burn! (<45 mins)
3. Explore 2: Inquiry Investigation - Anaerobic Respiration (1-2 hrs)
3. Explain (STEMscopedia)
4. Evaluate (CER, OER, MCA)</td><td>Resources
Gizmos Cell Energy Cycle

STEMScopes Intervention Guided Practice

Gizmos Cell Respiration Case Study</td><td>Rationale for use
This support is designed for students struggling to understand the basic concepts for this unit. It provides a scaffold through which they can deconstruct each process

The Guided Practice will allow students to deconstruct the anaerobic and aerobic processes using a differentiated scaffold.

The Extension Support is designed for higher-level students who are ready for more complex content</td></tr>
<tr><td>Wk 5 YL</td><td colspan="3">End of unit assessment, Performance Task, etc.</td></tr>
</table>

Unit Guide: Ecosystems and the Environment

The following unit guide provides a breakdown of Tier 1 instructional activities that should be completed for each topic, each week. Supplemental resources and activities are also provided and can be used to provide additional support for students who need Tier 2 or Tier 3 support (i.e., remediation and/or intervention).

<table>
<tr><td colspan="4">Unit Anchoring Phenomenon: Think about the height of the pandemic when we were all quarantined inside. Have students reflect on and investigate the impact of having large numbers of individuals in a confined space for a long period of time. They may consider what essential items run out the fastest, how the necessities differ when diverse people (i.e. young, mature, pregnant) live together, and what considerations need to be made in order to meet these diverse needs. The concept of carrying capacity requires an ecosystem to maintain homeostasis to sustain diverse life. Students can investigate how living in a specific area with a large number of different people (akin to quarantining with family) can impact resources and sustainability.</td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="3"><u>HS-LS2-2</u>. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
<u>HS-LS2-6.</u> Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions but changing conditions may result in a new ecosystem.

<u>Big Idea:</u> For an ecosystem to remain in homeostasis it must have biodiversity. Students should be able to understand that increased biodiversity improves species-to-species interactions which maintain ecological health.</td></tr>
<tr><td>Weeks (YL or 4x4)</td><td>Tier 1 Instructional Activities</td><td colspan="2">Tier 2 and 3 Supplemental Resources and Activities[1]</td></tr>
<tr><td>Week 1 (Year-Long)

Week 1 (4x4)</td><td>SCOPE: Biodiversity and Changes in Ecosystems
1. Engage: Hook - How Does a Grassland Respond (<30 mins)
2. Explore: Explore 1: Ecosystem Resilience
3. Explore: Explore 2: Activity - Population Dynamics (<45 mins)
4. Explain (STEMscopedia)
5. Elaborate: Pythons RCT
6. Evaluate (CER, OER, MCA)</td><td colspan="2"><table><tr><td>Resources</td><td>Rationale for use</td></tr><tr><td>Gizmos Forest Ecosystem</td><td>This resource is designed for students who require additional practice with the content.</td></tr><tr><td>STEMscopes Guided Practice</td><td>This resource is designed for students who have significant gaps in comprehension.</td></tr><tr><td>Video Support: Netflix Our Planet</td><td>This documentary examines how climate change impacts all living creatures on Earth.</td></tr></table></td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="3">HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

Big Idea: Students should understand that carrying capacity is the limit defined by available resources of how many living things an ecosystem can sustain.</td></tr>
<tr><td></td><td>SCOPE: Carrying Capacity</td><td colspan="2"><table><tr><td>Resources</td><td>Rationale for use</td></tr></table></td></tr>
</table>

Week 2 (Year-Long) Week 1 (4X4)	1. Engage: Hook - Device Island Survivor Game (<45 mins) 2. Explore 1: Activity - Factors Affecting Carrying Capacity (<45 mins) 3. Explore 3: Activity - To Build or Not to Build (<45 mins) 4. Explain (STEMscopedia) 5. Evaluate (CER, OER, MCA)	Gizmos Rabbit Population by Season	This resource will allow students to simulate the dynamics of carrying capacity in order to gain a better understanding.
		STEMscopes Guided Practice	This resource is designed to support students' comprehension of carrying capacity through hypothetical scenarios
		Video Support Link: Ecological Carrying Capacity	The quick four-minute documentary provides visuals to explain carrying capacity.
PE(s) and Big Ideas for this section	**HS-LS2-8.** Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. **Big Idea:** Students will be able to analyze the social behaviors of species and how they influence their ability to survive and increase evolutionary fitness.		
Weeks 3-4 (Year-Long) Week 2 (4X4)	**SCOPE: Animal Behavior and Survival** 1. Engage: Hook - Animal Card Charades (<30 mins) 2. Explore 1: Activity - Animal Behavior (1-2 hrs) 3. Explore 2: Activity - Strange Behavior (<45 mins) 3. Explain (STEMscopedia) 4. Evaluate (CER, OER, MCA)	**Resources**	**Rationale for use**
		Gizmos Animal Group Behavior	This middle school level interactive is designed to improve student comprehension of animal behavior through engagement with a behavioral simulator.
		STEMscopes Explain Concept Review Game	Students can practice core concepts with the Concept Review Game.
PE(s) and Big Ideas for this section	**HS-LS4-5.** Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species; (2) the emergence of new species over time; and (3) the extinction of other species. **Big Idea**: Students will be able to assess evidence of environmental changes in order to craft claims about their impacts on species fitness		
Week 5 (Year-Long) Week 3 (4X4)	**SCOPE: Environmental Impact on Species** 1. Engage: Hook - Environmental Impact on Species (<45 mins) 2. Explore 1: Activity - An Ecosystem's Story (<45 mins) 3. Explore 3: Activity - Same or Different? (<45 mins) 3. Explain (STEMscopedia) + Supported by Linking Literacy 4. Evaluate (CER, OER, MCA)	**Resources**	**Rationale for use**
		STEMscopes Guided Practice	The Tier 2 resource will allow students to engage with a variety of scenarios in order to determine their impact on native species. The Tier 3 support
		Gizmos Fruit Production and the Environment	The middle school level simulation can be scaffolded and can also be used as an extension activity.
		Video Support Link: Human Impact on the Environment	This four-minute video discusses the negative impact of humans on the Earth due to burning fossil fuels, deforestation and creating waste.

<table>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2"><u>HS-LS2-7</u>. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
Clarification Statement: Examples of human activities can include urbanization, building dams, and the dissemination of invasive species.
<u>HS-LS4-6.</u> Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
<u>HS-ETS1-3.</u> Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
<u>HS-ETS1-4.</u> Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

<u>Big Idea:</u> Students will be able to evaluate the impact of human behaviors on the ecosystem in order to develop a plan for how to minimize the impacts of these behaviors.</td></tr>
<tr><td>Week 6
(Year-Long)

Week 3
(4X4)</td><td>SCOPE: <u>Minimizing Human Impact on Earth</u>
1. Engage: <u>Accessing Prior Knowledge - Minimizing Human Impact on Earth</u> (<30 mins)
2. Explore 1: <u>Activity - Are We Destroying Our Planet?</u> (1-2 hrs)
3, Explore 2: <u>Activity - Life without Oxygen</u> (1-2 hrs)
4. Explain: <u>Content Connections Video</u>
5. Evaluate <u>(CER, OER, MCA)</u></td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td><u>STEMscopes Guided Practice</u></td><td>This support uses a graphic organizer to have students sort various scenarios by which harm or help the environment.</td></tr><tr><td><u>Gizmos Water Pollution</u></td><td>This support uses a virtual simulator to demonstrate the impacts of water pollution.</td></tr></table></td></tr>
<tr><td>Week 7
(Year-Long)

Week 4
(4X4)</td><td colspan="2">End of unit assessment, Performance Task, etc.</td></tr>
</table>

[1] These suggested activities can be used, where indicated, for remediation and/or intervention.

Unit Guide: Organization of Systems and Genetics

The following unit guide provides a breakdown of Tier 1 instructional activities that should be completed for each topic, each week. Supplemental resources and activities are also provided and can be used to provide additional support for students who need Tier 2 or 3 support (i.e., remediation and/or intervention).

<table>
<tr><td colspan="3">MAP MOY (YL)/ EOY (4x4): Work with testing coordinator to schedule testing (DCPS Assessments Canvas Page)</td></tr>
<tr><td colspan="3">Unit Anchoring Phenomenon: Have students use MileSplit.com to research speed data on track runners at their school. When looking at track runner data, why are some runners faster than others? How do their genetics play a role in their ability to win the race? How does their training and conditioning (including diet) impact their biological efficiency (how well the body operates)?</td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Big Idea: Students will deconstruct the organisms in order to better understand how system organization contributes to the function of the overall organism</td></tr>
<tr><td>Weeks (YL)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[1]</td></tr>
<tr><td>Week 1 (Year-Long)

Week 1 (4x4)</td><td>SCOPE: Organization of Systems
1. Engage: Accessing Prior Knowledge - Organization of Systems (<30 mins)
2. Explore 1: Activity - 3D Body System (1-2 hrs)
3. Explore 2: Activity - Let's Communicate (1-2 hrs)
4. Explain: Creative Skit
5. Evaluate (CER, OER, MCA)</td><td><table><tr><th>Resources</th><th>Rationale for Use</th></tr><tr><td>Gizmos Digestive System</td><td>Use the virtual simulator to demonstrate the structure and function of the digestive system.</td></tr><tr><td>STEMscopes Intervention Guided Practice</td><td>This support uses graphic organizers and other tools to scaffold content.</td></tr></table>*Consider animal dissections here.</td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Big Idea: Students will be able to investigate the feedback mechanisms (i.e., body temperature regulation, labor & giving birth, etc) that help the body to maintain homeostasis. They will be able to explain the foundational concepts of the mechanisms and their role in maintaining homeostasis.</td></tr>
</table>

Week 1 (Year-Long) Week 1 (4x4)	**SCOPE: Feedback and Homeostasis** 1. Engage: Accessing Prior Knowledge - Feedback and Homeostasis (<45 mins) 2. Explore 1: Scientific Investigation - Homeostasis, Activate! (1-2 hrs) 4. Explain: Creative Cartoon 5. Elaborate: Paramecium Homeostasis 6. Evaluate (CER, OER, MCA) **This scope should take about 1-2 days. The Cell Division scope can be introduced at the end of this week.*	**Resources** / **Rationale for use** Gizmos Human Homeostasis or Homeostasis — These supports can be scaffolded but will provide students with an engaging visual representation of homeostasis in the body. STEMscopes Intervention Guided Practice — This support uses graphic organizers and other tools to scaffold content. Gizmos Homeostasis — This alternate Explore or Extension activity is a case study where students take on the role of a physician assistant and help young man who has Type II diabetes and high blood pressure.
PE(s) and Big Ideas for this section	**HS-LS1-4.** Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. **Big Idea:** Students will be able to construct and use models to demonstrate cell division and its role in creating specialized cells. Students should understand that all specialized cells come from stem cells and differentiation is the process through which they develop specific traits in order to accomplish their genetic task.	
Week 2 (Year-Long) Week 2 (4x4)	**SCOPE: Cell Division and Complex Organisms** 1. Engage: Accessing Prior Knowledge - Cell Division and Complex Organisms (<30 mins) 2. Explore 1: Activity - The Life of a Cell (<45 mins) 3. Explore 4: Activity - Differentiation Game (<45 mins) 4. Elaborate: HHMI Cell Cycle and Cancer 5. Evaluate (CER, OER, MCA)	**Resources** / **Rationale for use** STEMscopes Content Connections Video — Use the content connections video to provide students with an additional visual representation of the cell division process. Gizmos Cell division — This cell division simulator can be used as an Explore or Explain activity. Spanish resources can be found in the community resources. Possible Lab Activity — If accessible, this is a great scope to introduce microscopes with, students can examine various cell types under the microscope and make observations and craft hypotheses about the natural cell division. **Video Support Link:** Cell Division Amoeba Sisters — This is an eight-minute cartoon that attempts to simplify cellular mitosis.
PE(s) and Big Ideas for this section	**HS-LS1-1.** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. **Big Idea:** Students will be able to discuss the structure of DNA and explain how it supports the function of creating protein structure. Students will be able to explain the relationship between DNA and proteins and the impact of genetic mutations on protein function.	
Week 2 (Year-Long)	**SCOPE: DNA to Proteins**	**Resources** / **Rationale for use**

<table>
<tr><td>Week 2
(4x4)</td><td>1. Engage: Hook - DNA to Proteins (<30 mins)
2. Explore 2: Activity - Make Me a Sandwich (<45 mins)
3. Explore 3: Scientific Investigation - Enzyme Simulation (1-2 hrs)
4. Explain: Content Connections Video
5. Elaborate: CRISPR RCT
6. Evaluate (CER, OER, MCA)</td><td><table>
<tr><td>STEMScopes Explore 1: Components of DNA</td><td>Students will construct and label a model of DNA in order to better understand the individual components.</td></tr>
<tr><td>Video Support Link:
DNA to Protein Explained</td><td>This 3D animation shows how proteins are made in the cell from the information in the DNA code. This clip is less than three minutes.</td></tr>
<tr><td>Gizmos Building DNA and RNA and Protein Synthesis</td><td>This support provides a more detailed virtual model for students to build DNA and explore how proteins are made using RNA.</td></tr>
<tr><td>PhET: Simulation Practice - Gene Expression Essentials</td><td>STEMScopes provides guided virtual worksheet for this simulation. Multiple languages can be found on the “Translations” tab of the PhET simulation.</td></tr>
</table></td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2"><u>HS-LS3-1.</u> Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
<u>HS-LS3-2.</u> Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
<u>HS-LS3-3.</u> Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

<u>Big Idea:</u> Students will be able to craft an argument for how genetic variation is created through meiosis and mutations. They will be able to use statistical concepts to explain how variation is expressed in a larger population.</td></tr>
<tr><td>Week 3
(Year-Long)

Week 3
(4x4)</td><td>SCOPE: Inheritance of Traits
1. Engage: Hook - The Genetic Book of Life (<45 mins)
2. Explore 1: Activity - How does DNA Code for Traits? (<45 mins)
3. Explore 2: Activity - Gene Expression (<45 mins)
4. Elaborate: HHMI Viral DNA Integration
5. Evaluate: CER, OER, MCA</td><td><table>
<tr><th>Resources</th><th>Rationale for use</th></tr>
<tr><td>STEMScopes: Accessing Prior Knowledge - Tic-Tac-Toe</td><td>This could be used as a warm-up, alternative Engage, or review activity.</td></tr>
<tr><td>Gizmos Building DNA</td><td>This interactive includes Spanish teacher created resources. Students construct a DNA molecule, examine its double-helix structure, and then go through the DNA replication process.</td></tr>
<tr><td>Video Support Link:
How Mendel's pea plants helped us understand genetics</td><td>This is a three-minutes TED Ed animated video explains how studying pea plants revealed why you have the traits that make you who you are.</td></tr>
</table></td></tr>
<tr><td>Week 4
(Year-Long)

Week 3
(4x4)</td><td>SCOPE: Variations in Traits
1. Engage: Hook - Superhero Traits (<45 mins)
2. Explore 2: Activity - The Big Mix-Up During Meiosis (<45 mins)
3. Explore 4: Activity-Genetics vs. Environment (1-2 hrs)
4. Explain (STEMscopedia)
5. Evaluate: CER, OER, MCA</td><td><table>
<tr><th>Resources</th><th>Rationale for use</th></tr>
<tr><td>STEMScopes Variations of Traits Guided Practice</td><td>Students will use creative skills to create a storyboard to explain genetics.</td></tr>
<tr><td>Gizmos Mouse Genetics (One Trait)</td><td>This support simulates genetic variations in mice.</td></tr>
<tr><td>Video Support Link:
How to Draw a Punnett Square</td><td>This a five-minute explainer video that demonstrates how to draw and use a Punnett square.</td></tr>
</table></td></tr>
</table>

Week 5 (Year-Long) Week4 (4x4)	**End of unit assessment, RCT, etc.**

[1] These suggested activities can be used, where indicated, for remediation and/or intervention.

Unit Guide: Evolution

The following unit guide provides a breakdown of Tier 1 instructional activities that should be completed for each topic, each week. Supplemental resources and activities are also provided and can be used to provide additional support for students who need Tier 2 or 3 support (i.e., remediation and/or intervention).

<table>
<tr><td colspan="4">MAP EOY: Work with testing coordinator to schedule testing (DCPS Assessments Canvas Page)</td></tr>
<tr><td colspan="4">Unit Anchoring Phenomenon: Students can engage with this unit through an investigation of the evolution of their teeth! Many people have their wisdom teeth pulled out because it can cause pain and overcrowding in the mouth. Have students consider why wisdom teeth originally developed and why we don't need them now. They may also consider what factors caused humans to need their wisdom teeth and which factors have allowed us to remove those teeth. To extend this lesson, have higher level students consider if at some point humans will ever evolve to not have these teeth at all.</td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="3">HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

Big Idea: Students will be able to understand that the theory of evolution is supported by multiple lines of empirical evidence and is centered around the concept of common ancestry.</td></tr>
<tr><td>Weeks (YL or 4x4)</td><td>Tier 1 Instructional Activities</td><td colspan="2">Tier 2 and 3 Supplemental Resources and Activities[1]</td></tr>
<tr><td>Week 1-2 (Year-Long)

Week 1 (4x4)</td><td>SCOPE: Evidence of Common Ancestry
1. Engage: Hook - Cladogram (<30 mins)
2. Explore 1: Activity - Evidence of Common Ancestry Stations (1-2 hrs)
3. Explore 2: Scientific Investigation - Comparison on Mammal Skulls (1-2 hrs)
4. Explain: Gizmos Cladograms
5. Evaluate (CER, OER, MCA)</td><td colspan="2"><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Gizmos Human Evolution-Skull Analysis</td><td>This resource will support the Explore 2 resource by providing students with a virtual simulation of human skulls to analyze for evidence of common ancestry.</td></tr><tr><td>STEMScopes Intervention Guided Practice</td><td>This support provides students with a graphic organizer to sort through the evolution of bears and then respond to comprehension questions.</td></tr></table></td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="3">HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

Big Idea: Students will be able to develop evidence-based explanations for how the four factors of evolution can result in evolutionary change</td></tr>
<tr><td>Weeks 3-4</td><td colspan="3">SCOPE: Factors of Evolution</td></tr>
</table>

<table>
<tr><td>(Year-Long)

Week 2
(4x4)</td><td>1. Engage: Hook - Beak Type (<45 mins)
2. Explore 1: Activity - Owl and Mouse (1-2 hrs)
3. Explore 2: Activity - Genetic Variation (1-2 hrs)
4. Explain: Stemscopedia
5. Elaborate: HHMI Using Data to Investigate Elephant Evolution
6. Evaluate (CER, OER, MCA)</td><td><table>
<tr><th>Resources</th><th>Rationale for use</th></tr>
<tr><td>STEMScopes Guided Practice</td><td>Guided Practice engages students with a card sort as they compare the anatomy of various species. Then they will use the comprehension questions to craft claims about the factors of evolution that resulted in the modern-day species.</td></tr>
<tr><td>HHMI Simulating Evolution of a Rock Pocket Mouse Population</td><td>Quick two-minute visual explanation that goes well with the Explore 1 activity. This animation shows how quickly an advantageous mutation can spread through a mouse population over multiple generations.</td></tr>
<tr><td>Gizmos Hardy-Weinberg Equilibrium</td><td>In this simulation students analyze population data to develop an understanding of the Hardy-Weinberg equilibrium. Determine how initial allele percentages will affect the equilibrium state of the population.</td></tr>
<tr><td>STEMScopes Concept Review Game</td><td>Alternate Explain activity or can be used to review scopes concepts.</td></tr>
<tr><td>Video Support Link: Five Fingers of Evolution</td><td>The TED Ed video is a short six-minute video as to how evolution can occur. This support using storytelling and animation to explain this concept.</td></tr>
</table></td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2"><u>HS-LS4-3.</u> Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
<u>HS-LS4-4.</u> Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

<u>Big Idea:</u> Students will be able to apply statistical concepts as evidence to support the claim that advantageous genetic traits can lead to an increase of the train within the gene pool. They will be able to discuss how the gene pool is impacted by natural selection.</td></tr>
<tr><td>Weeks 5-6
(Year-Long)

Week 3
(4x4)</td><td>SCOPE: Results of Natural Selection
1. Engage: Hook - The Beetle Bean Experiment (<45 mins)
2. Explore 1: Activity - Sickle Cell and Malaria (<45 mins)
3. Explain/Explore 2: Activity - Evolution of Traits and Statistics (1-2 hrs)
4. Elaborate: PhET Natural Selection
5. Evaluate (CER, OER, MCA)</td><td><table>
<tr><th>Resources</th><th>Rationale for use</th></tr>
<tr><td>Gizmos Bird Beaks</td><td>Students will engage with a virtual natural selection simulator to see how various factors can affect evolution.</td></tr>
<tr><td>Gizmos Natural Selection</td><td>For struggling students, move them to the Tier 3 support. This Gizmo specifically focuses on natural selection and will allow students to engage with one of the factors of evolution</td></tr>
<tr><td>Video Support Link: Natural Selection</td><td>This is an eight minute animated video that explains mutations and variations in a population.</td></tr>
<tr><td>STEMScopes Content Connections, Concept Review Game</td><td>Can be used for an alternate explain or concept review</td></tr>
<tr><td>Gizmos Evolution</td><td>This case study is an alternative elaborate or an extension that applies the concept of evolution to a real-world problem.</td></tr>
</table></td></tr>
<tr><td>Week 7
(Year-Long)</td><td colspan="2">End of unit assessment, Performance Task, etc.</td></tr>
</table>

Week 4 (4x4)	

[1] These suggested activities can be used, where indicated, for remediation and/or intervention.

Central Services Science Team Contacts

For more information or support around the DCPS science curriculum, aligned resources, and NGSS implementation, please contact us:

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