Biology: CCPS Science Unit Plan

Grade	9-12	**Subject**	Science	**Unit #**	3
Unit Name	Evolution and Changing Environment		**Timeline**	3 Weeks	
How to use the Framework	This Framework should be used to implement daily science instruction. The resources and instructional strategies reflected in the Framework will provide a foundation for effective implementation and student mastery of standards. Please see the hyperlinked abbreviation document to ensure understanding all abbreviations used with this framework.				
Unit Overview	*The Cells unit provides students with a foundational understanding of cells, focusing on their structure, function, and interactions. Students explore cell organelles, cellular processes like respiration and photosynthesis, macromolecules, and mechanisms of cellular regulation. Emphasis is placed on real-world applications and critical thinking skills, preparing students to understand the complexities of living organisms at the cellular level. Through laboratory investigations and inquiry-based learning, students develop scientific literacy and an appreciation for the interconnectedness of biological systems.				
Lesson Plan guidance document and template	Department of Science Guidance Document Lesson Plan Template Week View GADOE Science Updates				

3Dimensional Instruction

GSE	Science and Engineering Practices	Crosscutting Concepts
SB4. Obtain, evaluate, and communicate information to illustrate the organization of interacting systems within single-celled and multi-celled organisms. **SB6**. Obtain, evaluate, and communicate information to assess the theory of evolution.	Asking Questions and Defining Problems. Constructing Explanations and Designing Solutions. Engaging in Argument from Evidence. Obtaining and Communicating Information. Analyzing and Interpreting Data Using Mathematics and Computational Thinking Develop and use mathematical models	Patterns Energy and Matter Structure and Function Cause and Effect

NGSS Alignment	NGSS Alignment to Disciplinary Core Ideas

Weekly Lesson Tasks

Week 1	
GSE: SB4. Obtain, evaluate, and communicate	**Focused Concept: SB4a.** Construct an argument supported by scientific information to explain patterns in structures

information to illustrate the organization of interacting systems within single-celled and multi-celled organisms.	and function among clades of organisms, including the origin of eukaryotes by endosymbiosis. Clades should include archaea, bacteria, eukaryotes, fungi, plants, and animals (Clarification statement: This reflects 21st-century classification schemes and nested hierarchy of clades and is intended to develop a foundation for comparing major groups of organisms. The term 'protist' is useful in describing those eukaryotes that are not within the animal, fungal, or plant clades, but the term does not describe a well-defined clade or a natural taxonomic group.) **SB4b.** Analyze and interpret data to develop models (i.e., cladograms and phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms. **SB4c**. Construct an argument supported by empirical evidence to compare and contrast the characteristics of viruses and organisms.
SEP: • Asking Questions and Defining Problems. • Constructing Explanations and Designing Solutions. • Engaging in Argument from Evidence. • Obtaining and Communicating Information.	**CCC:** • Patterns • Energy and Matter • Structure and Function
Phenomenon: How do rainforest species communicate?	DQ: How are the characteristics of an organism related to its place in an ecosystem?

	Day 1	Day 2	Day 3	Day 4	Day 5
Learning Target	Students will explain patterns in structures and functions among clades of organisms.	Students will construct an argument supported by scientific information to explain patterns in structures and functions among clades of organisms.	Students will compare and contrast the characteristics of viruses and organisms. Support with evidence	Students will analyze and interpret data to develop models (i.e., cladograms and phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms.	Students will analyze and interpret data to develop models (i.e., cladograms and phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms.
Opening (10-15 minutes) Essential Vocabulary this week: Archaea Bacteria Eukaryote Fungi Plants Animals Cladogram	Show students the phenomenon and reading on pages 204-205. • Use the See-Think-Wonder protocol to guide student thinking. • Teachers should provide students with opportunities to share	Show students the image related to the phenomenon. • Use the See-Think-Wonder protocol to guide student thinking. • Teachers should provide students with opportunities to share observations and develop questions.	Show students the phenomenon on page 204. • Use the See-Think-Wonder protocol to guide student thinking. • Teachers should provide students with opportunities to share observations and develop questions.	Show students the image related to the phenomenon. • Use the See-Think-Wonder protocol to guide student thinking. • Teachers should provide students with opportunities to share observations and develop questions.	Show students the image related to the phenomenon. • Use the See-Think-Wonder protocol to guide student thinking. • Teachers should provide students with opportunities to share observations and develop questions.

Phylogenetic trees Endosymbiosis Viruses	observations and develop questions. -The students can record questions in whole groups or small groups. After the Discussion, show unit video 1 and ask the student the following question to do a "Quick chat." How do rainforest species communicate?	-The students can record questions in whole groups or small groups. After the Discussion, ask the student the following question. Predict: How do you think scientists might classify the different species of fungi in the picture? Ask for five readers to read a paragraph on page 210. Then discuss "NOS - Scientific knowledge" How have advancements in technology and scientific techniques affected how scientists classify microorganisms?	-The students can record questions in whole groups or small groups. After the Discussion, ask the student the following question. Ask some of the students to give some answers to the questions that have been asked. Encourage dialogue.	-The students can record questions in whole groups or small groups.	-The students can record questions in whole groups or small groups. After the Discussion, ask the student the following question. How do rainforest species communicate?
Guided Practice/ Transition (20 minutes)	TTW show the students different organisms and allow them to discuss their characteristics and functions. TTW, discuss the crosscutting concepts of structure and function in relation to the organisms. See page 208 in the teacher edition.	TTW, provide 15-20 minutes of direct instructions. Use the objectives below for your direct instruction. Lecture notes are provided in online teacher resources. ● Discuss the patterns in the different clades that make them unique for their environment.	TTW, provide 15-20 minutes of direct instructions. Use the objectives below for your direct instruction. Lecture notes are provided in online teacher resources. ● Identify the characteristics that are common to all viruses.	TTW, provide 15-20 minutes of direct instructions. Use the objectives below for your direct instruction. Lecture notes are provided in online teacher resources ● Go over Cladograms and Phylogenetic trees.	TTW, provide 15-20 minutes of direct instructions. ● Discuss patterns ● Go over Binomial Nomenclature ● Go over Dichotomous Keys
Independent Practice (45-50 minutes) **Lab preparation is needed this week.**	TSW create a graphic organizer sorting the different clades of organisms. Include the following clades: archaea, bacteria, eukaryotes, fungi, plants, and animals. Use TB pages 210-305 to research the required characteristics and	TSW pair up, each selecting an organism in the same clade. The teacher should have each group represent a different clade. Depending on class size, they will repeat. SW will research their organism and compare it to their partner's organism.	TSW, be divided into groups of 2-3. (teacher prep - cut the reading document into seven paragraphs and mix the order. Make unique lines so they don't match up like puzzles. You want them to read to put the paragraphs in order).	TSW, choose one animal or plant and research an example of a cladogram or phylogenetic tree (5 minutes). Ask the students to write what they understand about the image (5 minutes). Have them discuss with their table mates (5 minutes).	TSW finish their cladogram.

	functions. (you can provide a graphic organizer for them to fill in. or complete as a CER with a completed chart) -If students created their own or filled in the graphic organizer, they may need to finish homework. CER should finish in this class.	As a pair, explain the patterns in the structure and function of the organisms. Provide evidence (facts). Once finished, discuss it as a class. Then, have the students swap into pairs with a student in a different clade and do the same. Research to find patterns and explain those related structures and functions.	TSW will read the pieces of the paragraphs and place them in order. Once they have them in the correct order, they will write a summary that answers the following statement. Compare and contrast the characteristics of viruses and organisms. Support with evidence (facts). SW, work in the same groups to read, discuss, and complete a CER for the "Space Station stowaways" case study. TSW, include a list of questions in response to page 209 in TB: "Ask questions." In this chapter, you will study many diverse organisms, some closely related to those that live on the ISS. As you read, generate questions about how the characteristics of these organisms relate to where and how they live.	Then, have the students analyze and interpret the provided Cladogram individually. Once they have finished and shown the teacher evidence of understanding, the students will create their own cladogram using the provided activity. (This will continue the following day.)	
Assessment Summary (5-10 minutes)	Focus on the patterns of Archaea and Bacteria and explain the similarities of the two clades. Pick two other clades and do the same. Explain the similar patterns they have.	Have the students explain the information in the graph on page 209 and describe how it supports the ideas in the text.	What is the main reason that viruses are not considered to be living organisms?	Review and discuss the investigation's CER. Have the students pick one of their classmates' CERs and explain how their evidence supports the claim.	Write a brief paragraph using your knowledge and understanding from this week to explain how different species communicate in the same area.
Small Group Tasks (TBA)					

Week 2					
GSE: SB6. Obtain, evaluate, and communicate information to assess the theory of evolution.	**Focused Concept: SB6a.** Construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology. **SB6b.** Analyze and interpret data to explain patterns in biodiversity that result from speciation. **SB6c.** Construct an argument using valid and reliable sources to support the claim that evidence from comparative morphology (analogous vs. homologous structures), embryology, biochemistry (protein sequence) and genetics support the theory that all living organisms are related by way of common descent. **SB6e.** Develop a model to explain the role natural selection plays in causing biological resistance (e.g., pesticides, antibiotic resistance, and influenza vaccines).				
SEP: • Asking Questions and Defining Problems • Analyzing and Interpreting Data • Constructing Explanations and Designing Solutions			CCC: • Patterns • Cause and Effect • Scientific Knowledge Assumes an Order and Consistency in Natural Systems		
Phenomenon: How do hummingbirds become adapted to their environments?			**DQ: How do we know how species have evolved?** **DQ: How can changes in the environment generate diverse populations of organisms?**		
	Day 6	**Day 7**	**Day 8**	**Day 9**	**Day 10**
Learning Target	Students will gather evidence to describe how different species of hummingbirds are uniquely adapted to their environments.	Students will construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.	Students will construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.	Students will construct an argument using valid and reliable sources to support the claim that evidence from comparative morphology and genetics supports the theory that all living organisms are related by way of common descent.	Students will construct an argument using valid and reliable sources to support the claim that evidence from comparative morphology and genetics supports the theory that all living organisms are related by way of common descent.
Opening **(10-15 minutes)** Essential Vocabulary this week: Evolution Macroevolution Microevolution	Show students the phenomenon and reading on page 422. • Use the See-Think-Wonder protocol to guide student thinking.	Show students the phenomenon image on page 426 • Use the See-Think-Wonder protocol to guide student thinking.	Show students the phenomenon image on page 429. • Use the See-Think-Wonder protocol to guide student thinking.	Show students the phenomenon image on page 435. • Use the See-Think-Wonder protocol to guide student thinking.	Show students the phenomenon image on page 456. • Use the See-Think-Wonder protocol to guide student thinking.

Fossil Analogous structure Homologous structure Vestigial structure Adaptation Natural selection	• Teachers should provide students with opportunities to share observations and develop questions. -The students can record questions in whole groups or small groups. After the Discussion, show the **unit video 1,** then ask the student the following question to do a "Quick chat." How do hummingbirds become adapted to their environments?	• Teachers should provide students with opportunities to share observations and develop questions. -The students can record questions in whole groups or small groups. -Have the students read the paragraph under the picture on the same page.	• Teachers should provide students with opportunities to share observations and develop questions. -The students can record questions in whole groups or small groups. As you discuss, keep the students focused on prior knowledge from previous days.	• Teachers should provide students with opportunities to share observations and develop questions. -The students can record questions in whole groups or small groups. As you discuss, keep the students focused on prior knowledge from previous days. To enhance the discussion, you can have the students read the short paragraph on page 435, "Fossils and geological evidence," and discuss the Infer question on page 435.	• Teachers should provide students with opportunities to share observations and develop questions. -The students can record questions in whole groups or small groups. After the Discussion, show the **Video 15-1.** (page 457). As you discuss, keep the students focused on prior knowledge from previous days.
Guided Practice/ Transition (20 minutes	TTW. will present the "Explorer" on page 424. and answer the "Thinking Critically" infer question. What is the evolutionary benefit of an energy-conserving mechanism such as torpor? Then, have the students close read or read together using the popcorn strategy (ask students who want to read). After about 10-15 minutes show the Unit video 2 seen on page 425 (online material)	TTW, provide 15-20 minutes of direct instructions. Use the objectives below for your direct instruction. Lecture notes are provided in online teacher resources. ● Explain how evolution occurs at large and small scales. ● Differentiate the five lines of evidence that support evolution. ● Apply cladistics to explain evolutionary relationships (use the lecture notes and chapter commentary to help connect the concepts to the phenomena)	TTW, complete the "Connect to Mathematics" activity on page 429, analyzing Figure 14-2.	TTW, provide 15-20 minutes of direct instructions. Use the objectives below for your direct instruction. Lecture notes are provided in online teacher resources. ● Differentiate three different types of evidence used to determine evolutionary relationships and the history of life on Earth. Show the Video 14-1 (online material, page 435) Introduce developmental, anatomical, and genetic evidence. You can use the "engage" to connect the sections.	TTW, provide 15-20 minutes of direct instructions. Use the objectives below for your direct instruction. Lecture notes are provided in online teacher resources. ● Compare the differences and similarities between artificial selection and natural selection. ● Communicate the evidence that supports the theory of evolution. ● Evaluate the evidence for natural selection as a mechanism for evolution.
Independent Practice (45-50 minutes)	SW, talk amongst a group of 3-4 about the reading	SW, choose an everyday item that has changed	SW, complete the Mini Lab "Organizing fossil evidence	SW, work in groups of 2-3. Each group will be	SW, create their own evolutionary timeline.

	and video and construct questions that could be asked. After about 10 minutes, the students complete the **Virtual Investigation (online) on page 423**.	during their lifetime. Working in pairs, have them research the item of their choice, possibly including how the item changed prior to their lifetime. Have students create either a print or digital timeline showing these changes, as well as explaining the causes and effects of the change. Once completed, have students pair and share then they will study the figure 14-3 on page 431. Have the students list observable characteristics from one diagram to the next. Use the TB page 431 for more details. **Homework option:** SW, use the headings of section 14.1 as questions. As they read the section they will answer the questions. -How can we connect genetic variation with evolution? -How does evolution occur at different scales? -Explain Empirical evidence. -How do we piece together evolutionary evidence? -Describe how to connect evolutionary relationships.	" See page 434.	assigned either Developmental evidence, homologous structures, analogous structures, vestigial structures, or genetic evidence. The number of groups will vary based on class size. The students will create posters to describe visually and with a summary of their evidence. A gallery walk will be conducted. Each student should create a summary of each visual and presentation. *Students can take pictures and finish at home if time expires in class.	Encourage students to recreate the timeline in **Figure 15-2 on page 458** and identify any patterns or cause-and-effect relationships in the original timeline. After 30-35 minutes, have the students share their timeline with their elbow partner and discuss the observations they noticed. Have several of the students report what they discussed and noticed.
Assessment Summary (5-10 minutes)	Construct an explanation of how hummingbirds adapted to their environment.	Explain the difference between microevolution and macroevolution. Give an example of one.	Construct a conclusion using the SEP, Construct Explanations - How can you form an evolutionary tree of related species based on fossils?	Construct an explanation: Why do you think vestigial structures do not entirely disappear from a population?	Revisiting the Anchoring Phenomenon: Identify three types of evidence that scientists have used to determine the evolutionary history of hummingbirds.

Small Group Tasks (TBA)					

Week 3					
GSE: SB6. Obtain, evaluate, and communicate information to assess the theory of evolution.	**Focused Concept: SB6b.** Analyze and interpret data to explain patterns in biodiversity that result from speciation. **SB6d.** Develop and use mathematical models to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in populations of organisms. (Clarification statement: Element is intended to focus on basic statistical and graphic analysis. Hardy Weinberg would be an optional application to address this element.)				
SEP: • Asking Questions and Defining Problems • Analyzing and Interpreting Data • Using Mathematics and Computational Thinking • Constructing Explanations and Designing Solutions • Develop and use mathematical models			**CCC:** • Patterns • Cause and Effect		
Phenomenon: How do hummingbirds become adapted to their environments?			**DQ: Why do some new species emerge while others disappear?**		
	Day 11	**Day 12**	**Day 13**	**Day 14**	**Day 15**
Learning Target	Students will develop and use mathematical models to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in organism populations.	Students will develop and use mathematical models to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in organism populations.	Students will develop and use mathematical models to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in organism populations.	Students will analyze and interpret data to explain patterns in biodiversity that result from speciation.	Students will analyze and interpret data to explain patterns in biodiversity that result from speciation.
Opening (10-15 minutes) Essential Vocabulary this week: Allele frequency Directional selection Disruptive selection Gene pool Stabilizing selection adaptive radiation coevolution	Show students the phenomenon image on page 461. -Have the students read the paragraph under the picture on the same page. You can use the popcorn strategy for the students to read. Then, discuss the question. SEP: Construct an Explanation - Darwin	Show students the phenomenon image on page 467. • Use the See-Think-Wonder protocol to guide student thinking. • Teachers should provide students with opportunities to share observations and	Show students the phenomenon image and show the video. https://www.youtube.com/watch?v=xebyrVZjGl4 • Use the See-Think-Wonder protocol to guide student thinking. • Teachers should provide	Show students the phenomenon image. • Use the See-Think-Wonder protocol to guide student thinking. • Teachers should provide students with opportunities to share observations and develop questions.	Show students the phenomenon image on page 487. • Use the See-Think-Wonder protocol to guide student thinking. • Teachers should provide students with opportunities to share observations and

reproductive isolation speciation	considered the geologic theory of uniformitarianism to support his theory of how new species emerge. What do you think led him to this conclusion?	develop questions. -The students can record questions in whole groups or small groups. -Have the students read "Evolution in Populations" and Figure 15-9. Discuss the Analyze question: What environmental changes suggest that evolution can explain patterns?	students with opportunities to share observations and develop questions. -The students can record questions in whole groups or small groups. In the class, discuss and incorporate the question; Identify page 486-What factors could lead to a species diversifying into a new species?	-The students can record questions in whole groups or small groups.	develop questions. -The students can record questions in whole groups or small groups. Have the students read the caption of Figure 16-3. Have a quick chat on their thoughts in relation to their questions.
Guided Practice/Transition	TTW, provide 15-20 minutes of direct instructions. Use the objectives below for your direct instruction. Lecture notes are provided in online teacher resources. ● The theory of Natural Selection. ● Show Video 15-2 (Page 452 has the details and visuals)	TTW, provide 15-20 minutes of direct instructions. Use the objectives below for your direct instruction. Lecture notes are provided in online teacher resources. ● Describe how populations evolve due to environmental factors. ● Construct an explanation as to how the process of natural selection leads to adaptations. ● Relate change in the distribution of traits in a population to type of natural selection. (Hardy-Weinberg will be used in the activity today.)	TTW, provide 15-20 minutes of direct instructions. Use the objectives below for your direct instruction. Lecture notes are provided in online teacher resources. ● Describe evolution mechanisms that can influence allele frequency. ● Analyze how mechanisms of evolution affect genetic diversity in both small and large populations. Review pre-lab information. Transition to lab activity.	TTW, provide 15-20 minutes of direct instructions. Discuss with the students the pre-lab of chapter 16, Investigation A - Modeling Speciation.	TTW, provide 15-20 minutes of direct instructions. Use the objectives below for your direct instruction. Lecture notes are provided in online teacher resources. ● Describe the mechanisms of speciation. ● Differentiate the possible patterns in evolution that can exist between species.
Independent Practice (45-50 minutes) **Two Lab to prep this week**	TSW complete Minilab "Hawks and mice" on page 466.	TSW use the interactive versions of Figures 15-12, 15-13, and 15-14 to manipulate the graph and see how distributions change over time. SW, pair up and complete	TSW, complete **Chapter 15 Investigation A, "Genetic Drift."** Students will complete a CER to present their work.	TSW, start **Chapter 16 Investigation A, "Modeling Speciation"** Students will complete a CER to present their work.	TSW, continue **Chapter 16 Investigation A, "Modeling Speciation"** Students will complete a CER to present their work.

		the “Lookin at the data - Tracking Evolution” on pages 474-475.	Complete the Analysis and conclusion section.	Complete the Analysis and conclusion section.	Complete the Analysis and conclusion section.
Assessment/Summary (5-10 minutes)	SEP: Argue From Evidence Darwin thought that the development of these different types of finches was not a random process. Use the evidence from the food sources and beak types in Figure 15-8 to support this claim. (page 462)	Revisiting the Anchoring Phenomenon: Identify one advantage and one disadvantage of extreme adaptations and organisms such as the sword-billed hummingbird. (page 470) Assign Prelab for homework.	Describe how genetic changes have led to changes in populations of organisms.	Describe a form of evidence that supports the theory that all living organisms are related by way of common descent.	Explain the pattern(s) of biodiversity in the finch population.
Small Group Tasks (TBA)					

Assessment Prep

Prepare students for assessment by reviewing the following Assessment Prep Presentation.

Provide the following guidance:

Ask the students to use what they know about the tasks completed to answer the provided assessment prep question.

- What is the question asking you?
- What do you know about the vocabulary or concept in the question?
- Is this question similar to any investigations or tasks we’ve completed?
- How can what you’ve done help you answer this question?
- Just view the assessment question: What is the question asking you?

Guide students to think about how their experience connects to the question.

Using the answer choices provided, ask the students the following:

- Identify a wrong answer: How do I know this answer is incorrect?
- Identify the right answer: How do we know this answer is correct?

Allow the students time to discuss in collaborative groups.

Labs / Investigations		
Mandatory Labs	**Explore Learning Gizmo**	**Pivot Interactives/Phet**
Chapter 15 Investigation A		

Additional Resources/Tasks	
Supplemental Resources	**Chapter 16 Investigation A or** **ADI - Mechanism of Evolution**