Unit 06: Evolution

Content Area: **Science**
Course(s):
Time Period: **Marking Period 3**
Length: **6-7 weeks**
Status: **Published**

Summary

Introduction:

The focus of this unit is on natural selection as a mechanism of evolution. Students will learn about the various types of evidence of evolution and they will use this knowledge to demonstrate how modern species are descendants of ancestral species. Throughout the unit, students will be asked to explain how species are best adapted to their environment by relating the species to Darwin's four principles of natural selection. Students will participate in hands on activities and virtual simulations of how species adapt and change over time in order to become better suited to the environment. Adaptation will be related to how organisms must adapt to how human activity changes the environment and climate change. Students will also evaluate similarities and differences between species in order to organize species into various taxononmical groupings.

Revision Date: July, 2021

MA.K.MD	Measurement and Data
	Research to Build and Present Knowledge
LA.W.9-10.9	Draw evidence from literary or nonfiction informational texts to support analysis, reflection, and research.
	Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors.
SCI.HS-LS4	Biological Evolution: Unity and Diversity
SCI.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.
	Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.
	Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.
	Constructing Explanations and Designing Solutions
	Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
	Construct an explanation based on valid and reliable evidence obtained from a variety of

	sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
SCI.HS.LS4.B	Natural Selection
	Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.
SCI.HS.LS4.C	Adaptation
	Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment.
	Cause and Effect
	Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
SCI.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.
	Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.
	Engaging in Argument from Evidence
	Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in science.
	Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments.
SCI.HS.LS4.C	Adaptation
	Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species.
	Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.
	Emphasis is on testing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.
WRK.9.2.12.CAP	Career Awareness and Planning
TECH.9.4.2.DC.2	Explain the importance of respecting digital content of others.
	Individuals from different cultures may have different points of view and experiences.
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
	Young people can have a positive impact on the natural world in the fight against climate change.

Essential Questions/ Enduring Understandings

Essential Questions:

How do certain populations demonstrate Darwin's principles of evolution?
How can natural selection be used as a mechanism of evolution?
How can the major patterns of evolution be applied to populations?
How can you classify a group of provided species?
What are classification and taxonomy?
What is binomial nomenclature?

Enduring Understanding:

The reasons why Charles Darwin is known as the "Father of Evolution"
The difference between natural selection and artificial selection.
Molecular biology is used as evidence of evolution.

Objectives

Students will know key vocabulary: natural selection, artificial section, evolution, homologous structure, vestigial structure, fossil, adaptation, classification, taxonomy, binomial nomenclature, phylogeny, cladogram, donamin, kingdom, species.
Students will know the evidence that supports the theory of evolution.
Students will know how Charles Darwin contributed to the theory of evolution.
Students will know the four principles of natural selection.
Students will know how natural selection acts on a population.
Students will know populations change, not individuals.
Students will know patterns of evolution.
Students will know how species are grouped taxonomically.

Students will be skilled at applying the four principles of natural selection to real-world populations.
Students will be skilled at identifying real-world applications of anatomical evidence of evolution.
Students will be skilled at classifying organisms based on similarities and differences.
Students will be skilled at connecting patterns of evolution to real-world examples.
Students will be skilled at creating adaptations that would enhance the survival and reproduction of organisms in a specific environment.

Learning Plan

Theory of Evolution Discussion: students will be divided into groups that will read about the various scientists who contributed to the theory of evolution (Lamarck, Darwin, and Wallace). The whole class will then discuss each scientist's theory and the evidence he had to support it. Students will discuss the validity of each scientist's claim, using their understanding of evolution.

Charles Darwin: students will learn about the voyage of Charles Darwin by reading online articles and watching videos. Students will answer questions about how Darwin's observations lead to his theory of

evolution.

Galapagos Tortoises: students will read descriptions of the various islands on the Galapagos and of the different tortoise species found in the Galapagos. Students will match the tortoise to the island to which the population is best adapted.

Evidence of Evolution Notes: students will read and take notes on evidence of evolution. The notes will include real-world examples of evidence, including anatomy, biochemistry, and geography. Students will practice identifying the types of evolution from provided scenarios.

Peppered Moth Simulation: students will complete a lab simulation in which they will model how a peppered moth population adapts to its environment. Students will learn about how the industrial revolution resulted in the pollution that altered the moth's environment. This can be applied to current trends in human activity altering the environment. Students will use black and white paper to simulate the coloration of trees the moths are camouflaged to. Students will be timed as they pick up as many black and white paper circles on the two backgrounds, to simulate predation on moths. Students will record the number of moths left after each trial and analyze the trends in coloration of the population versus the environment. Students can write a CER statement or a formal lab report which connects the evidence collected in the simulation to the principles of natural selection.

Evolution Research Project: students will be able to choose a topic related to evolution (human evolution, the evolution of a certain species, adaptations, etc.) which they will research. Students will use the media center databases to conduct research on their topic and compose a research paper. Students will present their findings to the class.

Taxonomy Candy Lab: students will pick five candy brands for which they will create a cladogram. Students will evaluate the candy bars for similar traits that they will use to order the candy bars into a cladogram. Students will justify their created taxonomy using evidence from observations of the candy bars and reasoning from an understanding of evolution.

Evolution Prompts: throughout the unit, students will be asked to respond to prompts related to evolution. Students will have to write a paragraph answering the prompt. An example of a prompt is, "pick your favorite plant and animal species and explain how it relates to Darwin's principles of natural selection."

Speciation Lab: At the start of the activity, the class will pick a species that will represent the original population. Students will describe how the original population is adapted to its habitat and describe the habitat. Then, students will be divided into groups. Each group will be assigned a different, new habitat. Students will brainstorm how the original population will have to change over time to better survive in the new habitat. Students will create the new species, using the traits they brainstormed. They will explain why the species adapted such traits and draw an image of the resulting new species.

The Sixth Extinction Poster: students will learn about how the planet is undergoing a current mass extinction rate. Students will research the current extinction rate and compare it to the "normal" background extinction rate. Students will choose a specific species (plant, animal, or bacteria) and research how the species is impacted by climate change. Students will predict what will happen to the species if climate change continues and design an adaptation that will enable the species to survive a changing climate.

Assessment

Formative:

- Do Now Questions
- Exit Ticket Questions
- Evolution Prompts
- Participation in class discussions
- Quizzes
    - Evidence of Evolution
    - Patterns of Evolution

Summative:

- Unit Assessment
- Formal Lab Report - Peppered Moth Simulation

Benchmark:

- Biology Final Exam

Alternative Assessements:

- Evolution Research Project
- Evolution of a species cartoon

Materials

Biology Glencoe Textbook
SmartBoard and Computers
Evolution PowerPoint
Evolution Guided Notes
Evolution Paper and Electronic Lesson Materials (worksheets, packets, projects)
Lab Supplies
Goggles
Gloves
Black and white paper
Different shaped beans, spoons, toothpicks, tweezers, forks.
Timer.
Media Center Databases.

Integrated Accommodation and Modifications

https://docs.google.com/spreadsheets/d/1uDlwQcgdvbrOcLnMAKouOe1gQph5rWDWxM74UFeuACM/edit?usp=sharing