CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
BIOLOGY HONORS

Biology Honors Curriculum Guide

Pacing Guide

Unit 1: Matter and Energy Transformations in Ecosystems……..Instructional days: 20

In this unit of study, students construct explanations for the role of energy in the cycling of matter in organisms and ecosystems. They apply mathematical concepts to develop evidence to support explanations of the interactions of photosynthesis and cellular respiration, and they will develop models to communicate these explanations. Students also understand organisms' interactions with each other and their physical environment and how organisms obtain resources. Students utilize the crosscutting concepts of matter and energy and systems, and system models to make sense of ecosystem dynamics. Students are expected to use students construct explanations for the role of energy in the cycling of matter in organisms and ecosystems. They apply mathematical concepts to develop evidence to support explanations as they demonstrate their understanding of the disciplinary core ideas.

This unit is based on HS-LS2-4 and HS-LS2-5.

Unit 2: Interdependent Relationships in Ecosystems……..Instructional days: 20

In this unit of study, students formulate answers to the question "how and why do organisms interact with each other (biotic factors) and their environment (abiotic factors), and what affects these interactions?" Secondary ideas include the interdependent relationships in ecosystems; dynamics of ecosystems; and functioning, resilience, and social interactions, including group behavior. Students use mathematical reasoning and models to make sense of carrying capacity, factors affecting biodiversity and populations, the cycling of matter and flow of energy through systems. The crosscutting concepts of scale, proportion, and quantity and stability and change are called out as organizing concepts for the disciplinary core ideas. Students are expected to use mathematical reasoning and models to demonstrate proficiency with the disciplinary core ideas.

This unit is based on HS-LS2-1, HS-LS2-2, and HS-LS2-6.

Unit 3: Human Activity and Climate…….Instructional days: 20

In this unit of study, students examine factors that have influenced the distribution and development of human society; these factors include climate, natural resource availability, and natural disasters. Students use computational representations to analyze how earth systems and their relationships are being modified by human activity. Students also develop an understanding of how human activities affect natural resources and of the interdependence between humans and Earth's systems, which affect the availability of natural resources. Students will apply their engineering capabilities to reduce human impacts on earth systems and improve social and environmental cost–benefit ratios. The crosscutting concepts of cause and effect, systems and systems models, stability and change, and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for the disciplinary core ideas. Students will analyze and interpret data, use mathematical and computational thinking, and construct explanations as they demonstrate understanding of the disciplinary core ideas.

This unit is based on HS-ESS3-1, HS-ESS3-6, HS-ESS3-5, HS-ESS3-4, and HS-ETS1-3.

Unit 4: Human Activity and Biodiversity……Instructional days: 20

In this unit of study, mathematical models provide support for students' conceptual understanding of systems and students' ability to design, evaluate, and refine solutions for reducing the impact of human activities on the environment and maintaining biodiversity. Students create or revise a simulation to test solutions for mitigating adverse impacts of human activity on biodiversity. Crosscutting concepts of systems and system models play a central role in students' understanding

of science and engineering practices and core ideas of ecosystems. Mathematical models also provide support for students' conceptual understanding of systems and their ability to develop design solutions for reducing the impact of human activities on the environment and maintaining biodiversity.
This unit is based on HS-ESS3-3, HS-LS2-7, HS-LS4-6, HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, and HS-ETS1-4

Unit 5: Cell Specialization and Homeostasis……Instructional days: 20

Students formulate an answer to the question "How do the structures of organisms enable life's functions?" Students investigate explanations for the structure and functions of cells as the basic unit of life, of hierarchical organization of interacting organ systems, and of the role of specialized cells for maintenance and growth. The crosscutting concepts of structure and function, matter and energy, and systems and system models are called out as organizing concepts for the disciplinary core ideas. Students use critical reading, modeling, and conducting investigations. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.
This unit is based on HS-LS1-1, HS-LS1-2, HS-LS1-3, and HS-LS1-4.

Unit 6: DNA and Inheritance……Instructional days: 20

Students analyze data develop models to make sense of the relationship between DNA and chromosomes in the process of cellular division, which passes traits from one generation to the next. Students determine why individuals of the same species vary in how they look, function, and behave. Students develop conceptual models of the role of DNA in the unity of life on Earth and use statistical models to explain the importance of variation within populations for the survival and evolution of species. Ethical issues related to genetic modification of organisms and the nature of science are described. Students explain the mechanisms of genetic inheritance and describe the environmental and genetic causes of gene mutation and the alteration of gene expressions. The crosscutting concepts of structure and function, patterns, and cause and effect are used as organizing concepts for the disciplinary core ideas. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.
This unit is based on HS-LS1-4, HS-LS3-1, and HS-LS3-2.

Unit 7: Natural Selection……..Instructional days:20

Students constructing explanations and designing solutions, analyzing and interpreting data, and engaging in argument from evidence investigate to make sense of the relationship between the environment and natural selection. Students also develop an understanding of the factors causing natural selection of species over time. They also demonstrate and understandings of how multiple lines of evidence contribute to the strength of scientific theories of natural selection. The crosscutting concepts of patterns and cause and effect serve as a organizing concepts for the disciplinary core ideas. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.
This unit is based on HS-LS4-4, HS-LS4-3, HS-LS4-5, and HS-LS2-8.

Unit 8: Evolution…….…….instructional days: 20

Students construct explanations for the processes of natural selection and evolution and then communicate how multiple lines of evidence support these explanations. Students evaluate evidence of the conditions that may result in new species and understand the role of genetic variation in natural selection. Additionally, students can apply concepts of probability to explain trends in population as those trends relate to advantageous heritable traits in a specific environment. Students demonstrate an understanding of these concepts by obtaining, evaluating, and communicating information and constructing explanations and designing solutions. The crosscutting concepts of patterns and cause and effect support the development of a deeper understanding.
This unit is based on HS-LS4-1 and HS-LS4-2.

Interdisciplinary Connections	Math HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities HSA.SSE.A.1: Interpret expressions that represent a quantity in terms of its context HSA.CED.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. ELA RST.9-10.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics. RST.9-10.5. Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). RST.9-10.6. Determine the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. RST.9-10.8. Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. RST.9-10.9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. RST.9-10.10. By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently. WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence. A. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. B. Develop claim(s) and counterclaims using sound reasoning, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns. WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

	D. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. WHST.9-10.6. Use technology, including the Internet, to produce, share, and update writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. WHST.9-10.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
21st Century Life and Careers:	9.2.12.C.1 Review career goals and determine steps necessary for attainment. 9.2.12.C.3 Identify transferable career skills and design alternate career plans.
Technology Standards	8.2.12.B.2 Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product. 8.2.12.B.4 Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants. 8.2.12.B.5 Research the historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product, and present the competing viewpoints to peers for review. 8.2.12.C.4 Explain and identify interdependent systems and their functions.
NJSLS Career Ready Practices – These practices are demonstrated throughout the curriculum	CRP1. Act as a responsible and contributing citizen and employee. CRP2. Apply appropriate academic and technical skills. CRP3. Attend to personal health and financial well-being. CRP4. Communicate clearly and effectively and with reason. CRP5. Consider the environmental, social and economic impacts of decisions. CRP6. Demonstrate creativity and innovation. CRP7. Employ valid and reliable research strategies. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity. CRP12. Work productively in teams while using cultural global competence.

Differentiation/Accommodations/Modifications

Gifted and Talented	English Language Learners	Students with Disabilities	Students at Risk of School Failure
Extension Activities • Conduct research and provide presentation of mathematical topics. • Design surveys to generate and analyze data to be used in discussion. • Use of higher level questioning techniques. • Provide assessments at a higher level of thinking.	**Modifications for Homework/Assignments** • Modified assignments. • Extended time for assignment completion as needed. • Use graphing calculator. • Highlight formulas.	*(appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team)* **Modifications for Classroom** • Ask students to restate information, directions, and assignments. • Repetition and practice. • Model skills / techniques to be mastered. • Extended time to complete class work. • Provide copy of class notes. • Preferential seating to be mutually determined by the student and teacher. • Students may request books online, on tape/CD, as available and appropriate. • Assign peer helper in the class setting. • Provide regular parent / school communication • Provide oral reminders and check student work during independent work time. • Assist student with long and short term planning of assignments	**Modifications for Classroom** • Ask students to restate information, directions, and assignments. • Repetition and practice. • Model skills / techniques to be mastered. • Extended time to complete class work. • Provide copy of class notes. • Preferential seating to be mutually determined by the student and teacher. • Students may request books online, on tape/CD, as available and appropriate. • Assign peer helper in the class setting. • Provide oral reminders and check student work during independent work time. • Assist student with long and short term planning of assignments • Provide regular parent / school communication. • Assign peer helper in the class setting.

		Modifications for Homework • Extended time to complete assignments. • Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases. • Provide the student with clearly stated (written) expectations and grading criteria for assignments. **Modifications for Assessments** • Extended time on classroom tests and quizzes. • Student may take / complete tests in an alternate setting as needed. • Restate, reread, and clarify directions/questions. • Distribute study guide for classroom tests. • Establish procedures for accommodations / modifications for assessments.	• Provide oral reminders and check student work during independent work time. • Assist student with long and short term planning of assignments **Modifications for Homework** • Extended time to complete assignments. • Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases. • Provide the student with clearly stated (written) expectations and grading criteria for assignments. **Modification for Assessments** • Extended time on classroom tests and quizzes. • Student may take / complete tests in an alternate setting as needed. • Restate, reread, and clarify directions/questions. • Distribute study guide for classroom tests. • Establish procedures for accommodations / modifications for assessments.

Unit 1: Matter and Energy Transformations in Ecosystem

Content: Photosynthesis, Respiration, nutrient Cycles, trophic levels and food webs

Essential Questions:
How and why do organisms interact with each other (biotic factors) and their environment (abiotic factors), and what affects these interactions?
What is the role of energy in the cycling of matter in organisms in the ecosystem?
How do organisms obtain resources

Standards:
HS-LS2-4 and HS-LS2-5.

Time Frame: 20 days

Materials:
Modern Biology 2009; Holt Rinehart and Winston
Lab supplies
Smart board
Lap top computers
Graph paper
Colored pencils
Calculators

Content: *As a result of this learning segment, students will know…*
Respiration and Photosynthesis
Abiotic and Biotic factors
Carbon cycle and Nitrogen cycle
Interdependence of organisms and the ecosystem
Food webs, Energy pyramids, and trophic levels
Energy conservation

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
- Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem

Engage: Anticipatory Set:

- Carbon Footprint Activity: Students estimate their own carbon footprint as they relate the connection between photosynthesis and cellular respiration. http://footprint.wwf.org.uk/
- Engage students with a Biome in a Bottle activity. Students build a closed system and study the recycling of energy and matter within a closed system. www.sciencenc.com/event-help/eventphotos/BottleBiome_picture_page.php

Exploration:

Popcorn Energy Flow Lab

This activity requires the students to build 3D models of energy flow through an ecosystem.

http://www.nabt.org/websites/institution/File/pdfs/2010%20OBTA%20Activities/Anna_Scott_GA%20Share_a_thon_lesson.pdf

Design Lab: Nitrogen

In this lesson, students will investigate how a functional nitrogen cycle is an essential part of healthy agricultural systems. How might we use models to help us understand how the nitrogen cycle becomes disrupted and what might be done to prevent disruption?

http://betterlesson.com/lesson/639573/design-lab-nitrogen-3-of-4

Ecological Pyramids Virtual Lab Activity

In this activity, students will investigate how energy cycles through the environment through different trophic levels within an ecosystem. Students will mathematically model activity within ecosystems and extend this knowledge to other ecosystems.

http://www.iteachdemo.com/jquery/document/65_661EcologicalPyramidVirtualLab.pdf

Plants Respire Too!

In this lesson, students will investigate plants, like animals and many microbes, respire and utilize energy to grow and reproduce (http://c.ymcdn.com/sites/my.aspb.org/resource/group/a9372bf4-9ae4-4d0b-ad0c-595c9dfc3543/12labs/05_respiration_and_energy.pdf)

Virtual Lab: Carbon Transfer Through Snails and Elodea

In this virtual lab, students will investigate how carbon dioxide cycles through a biological system

http://www.classzone.com/cz/books/bio_09/resources/htmls/virtual_labs/virtualLabs.html

Making the Connection: Photosynthesis and Cellular Respiration

In this activity, students will make the connection between plants and animals and be able to describe the inter-dependence using chemical reactions as evidence.

http://betterlesson.com/lesson/635467/making-the-connection-photosynthesis-and-cellular-respiration

Do Plants Consume or Release CO2?

http://biologycorner.com/worksheets/photosynthesis_phenol.html

Explanation:

In these lessons

- Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.
- Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.
- Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.

PS3.D: Energy in Chemical Processes

The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. (secondary)

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved.
Elaboration: Photosynthesis and Respiration http://www.uplifths.org/ourpages/auto/2014/2/22/56973082/14%20Photosynthesis%20and%20Respiration-S.pdf POGIL Worksheets http://www.howellschools.com/webpages/asteinackerrob/files/22_nutrient_cycles-s.pdf Ecological Pyramids http://teacherweb.com/VA/MassaponaxHighSchool/FernandaKain/26-Ecological-Pyramids-S.pdf
Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)* Summative : Lab worksheets, Tests, Quiz Formative : homework, classwork, exit tickets, class participation

Unit 2: : Interdependent Relationships in Ecosystems

Content: Biodiversity, Ecosystems and Population Biology

Essential Questions:
How and why do organisms interact with each other (biotic factors) and their environment (abiotic factors), and what affects these interactions?
How many organisms can the earth support?

Standards:
HS-LS2-1, HS-LS2-2, and HS-LS2-6.

Time Frame: 20 days

Materials:
Modern Biology 2009; Holt Rinehart and Winston
Lab supplies
Smart board
Lap top computers
Graph paper
Colored pencils
Calculators

Content: *As a result of this learning segment, students will know…*
Biodiversity
Populations and Habitat Carrying capacity
Ecosystems and Interactions and Equilibrium
Replacement rate, mortality, reproduction
Human and non-human ecological disturbances

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
- Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- 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.

Engage: *Anticipatory Set*

- Watch video that poses the question "Can we expand our carrying capacity?" https://www.youtube.com/watch?v=lS_msYArtvY
- The following NPR podcast explains the rise and fall of population of the American Bison. From a population of 30 to 60 million animals roaming throughout North America, bison reached a low of 100 in the wild in the late 1800's. Since 1908, the National Bison Range has played an important role in

the successful recovery of these magnificent animals. *Podcast covers an update on the Bison population and the expansion of their habitat. http://www.npr.org/2016/02/04/465607203/montana-governor-allows-wild-bison-to-roam-outside-of-yellowstone

- The Galápagos Islands are home to animals and plants found nowhere else on Earth. The volcanoes that created the islands even help keep life going. Using the following videos, students will be able to view how an untouched environment shows the purest forms of how ecosystems interact naturally without human interruption. https://www.opened.com/video/how-do-ecosystems-change-over-time-youtube/212038, http://video.nationalgeographic.com/video/ecuador_galapagos

Exploration: *Student Inquiry*

Population Biology: Virtual Lab
http://www.mhhe.com/biosci/genbio/virtual_labs_2K8/pages/PopulationBiology.html

Data Analysis Activities

Maine Lake Fish: http://participatoryscience.org/standard/hs-ls2-1

Glass Eels: http://participatoryscience.org/standard/hs-ls2-1

Deer on the Kaibab Plateau: http://www.biologycorner.com/worksheets/kaibab.htm

Colony Collapse Disorder and an Analysis of Honey Bee Colony Numbers
http://www.nextgenscience.org/sites/ngss/files/HS-LS_Bee_Colony_version2.pdf
In this task, students will use data from domestic honey bee populations as a model within which to study the dynamics of Colony Collapse Disorder. Students will discover how to represent the above information in mathematical form using data charts, graphs, or other methods that they can formulate representations with.

Connection to Agriculture
https://www.cbd.int/agro/whatstheproblem.shtml
Explore the impact that biodiversity (or lack of biodiversity) has on agriculture. Students will relate their data from the NGSS task to the agricultural field.

Wolves of Yellowstone
http://www.pbslearningmedia.org/resource/331db173-a528-46ae-985c-e2432ebc6dc2/wolves-of-yellowstone-teacher-guide/
Watch videos and complete activities that investigate the effects of the removal of the wolf population from Yellowstone National Park and the impacts that it has had on varied populations through time.

Ecosystem in a Jar- Lesson 6
http://earthref.org/SCC/lessons/2010/ecology/#day3

Rabbit and Wolves Simulation
http://www.shodor.org/interactivate/activities/RabbitsAndWolves/Run various simulations and collect data over periods of time that illustrate how factors affect populations over time. Examples include: reproduction rate, age, disease, fire, chaos, etc.

Mt. St. Helen's: A Story of Succession
https://www.plt.org/stuff/contentmgr/files/1/47089543432aae6ee76a2c1d9fd698cf/files/focus_on_forests_activity_2_sp_1_mount_st_helens.pdf

Explanation: *Concepts and Practices*

In these lessons

- Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.
- Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.
- Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

LS2.A: Interdependent Relationships in Ecosystems

Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

Elaboration: *Extension Activity*

Predator & Prey Simulation: The Lynx Eats the Hare

http://www.flinnsci.com/Documents/demoPDFs/Biology/BF10109.pdf

Possible extension: After every three rounds of play have students draw a random card that has a density-dependent or density-independent variable on it.

Case study that analyzes the various threats to biodiversity in bird populations of Hawaii

http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=449&id=449

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

Summative : Lab worksheets, Tests, Quiz

Formative : homework, classwork, exit tickets, class participation

Unit 3: Human Activity and Climate

Content: Climate Change and human Activity

Essential Questions:
How are earth systems and their relationships being modified by human activity?
How do human activities affect natural resources?
How can we reduce human impacts on earth systems and improve social and environmental cost benefit ratios?

Standards:
HS-ESS3-1, HS-ESS3-6, HS-ESS3-5, HS-ESS3-4, and HS-ETS1-3.

Time Frame:20 days

Materials:
Modern Biology 2009; Holt Rinehart and Winston
Lab supplies
Smart board
Lap top computers
Graph paper
Colored pencils
Calculators

Content: *As a result of this learning segment, students will know…*
Climate change and factors that effect it
Natural Resources and Natural Hazards
Impact and changes in Human activity
Climate models &Geoscience Data
Graphing and forcasting

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity
- Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
- Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
- Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Engage: *Anticipatory Set*
PBS: Water World: The following video will provide students with a look into the impacts that climate change in having in Bangladesh.

http://www.pbs.org/now/shows/543/index.html
Sinking Islands
View the following video and discuss how the negative impacts of climate change on island communities.
http://www.emtv.com.pg/article.aspx?slug=Kivalina-Carteret-Similarities-of-the-Sinking-Islands&
NASA: How Does Climate Change Affect Humans?
https://www.opened.com/video/nasa-how-does-climate-change-affect-humans/5786128
Climate Challenge : A BBC created virtual Exploration of changing global climate patterns. Players must respond to catastrophic events caused by climate change as well as natural and manmade events, which may or may not be linked to climate change. This aspect of the game is meant to give some idea of what could happen as the Earth's climate changes and also introduce the unpredictable nature of some natural events.
http://www.bbc.co.uk/sn/hottopics/climatechange/climate_challenge/aboutgame.shtml

Exploration: *Student Inquiry*
Construct an argument explaining how these factors have influenced human activity
The following sites provide insight into how the availability of natural resources, the occurrence of natural hazards, and climate change have influenced human activity. After analyzing this information, students will construct an argument explaining how these factors have influenced human activity. Explanations should include specific evidence from these sources.
Indigenous Peoples; http://nca2014.globalchange.gov/report/sectors/indigenous-peoples
Land Use and Land Cover: http://nca2014.globalchange.gov/report/sectors/land-use-and-land-cover-change
Rural Communities http://nca2014.globalchange.gov/report/sectors/rural-communities#intro-section
Human Health http://nca2014.globalchange.gov/report/sectors/human-health#intro-section)
Climate Interactive
https://www.climateinteractive.org/tools/c-learn/simulation/
https://www.climateinteractive.org/programs/world-climate/instructor-resources/
Teh C-Learn activity will help students understand the long-term climate effects (CO2 concentrations, global temperature, sea level rise) of various actions to change CO2 emissions, like those from fossil fuels, deforestation, and planting trees.
My2050
A UK based animation that investigates the impacts of personal, regional, and national choices and policies and their impact on global warming. Extensions should be investigated for students to discover the economic impacts of their given plans, as well as the risk of the implemented systems for engineers, and overall cost-benefit analysis of their plans
http://my2050.decc.gov.uk/
Graphing surface temperature
Students will graph earth's temperature over the past 500 years and forecast future trends.

Explanation: *Concepts and Practices*
In these lessons
- Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.

- Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.
- Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

ESS3.A: Natural Resources
Resource availability has guided the development of human society.
ESS3.B: Natural Hazards
Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.
ESS2.D: Weather and Climate
Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary)
ESS3.D: Global Climate Change
Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.
ESS3.C: Human Impacts on Earth Systems
Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.
ETS1.B: Developing Possible Solutions
When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary)

Elaboration: *Extension Activity*
Climate Poker
http://www.spieledealer.de/bewitched/bewitched.php?menu=1&menu2=11&language=_e
Climate and the Biosphere
http://serc.carleton.edu/eslabs/weather/index.html
How Do Humans Change our Planet?
https://sites.google.com/site/earthsciportal/how-do-humans-change-our-planet
Additional Online Activities: STEM on the Brain
https://www.stemonthebrain.com/resources/codes/hs-ess3-1

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*
Summative : Lab worksheets, Tests, Quiz
Formative : homework, classwork, exit tickets, class participation

Unit 4: Human Activity and Biodiversity

Content: Mathematical models used to design, evaluate and refine solutions for reducing human impact

Essential Questions:
How can we reduce the impact of human activity on the environment?
What are the economic impacts of reducing human activities that adversely affect the environment?

Standards:
HS-ESS3-3, HS-LS2-7, HS-LS4-6, HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, and HS-ETS1-4

Time Frame:

Materials:
Modern Biology 2009; Holt Rinehart and Winston
Lab supplies
Smart board
Lap top computers
Graph paper
Colored pencils
Calculators

Content: *As a result of this learning segment, students will know…*
Biodiversity and factors that effect it
Natural Resources and Natural Hazards
Extinction, invasive species, natural disasters
Cost benefit analysis
Impact and changes in Human activity

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity
- Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- 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.
- Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
- 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.
- Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

- 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.

Engage: *Anticipatory Set*

CNN news document that allows the students to understand the last standing of the Northern White Rhino. Showing the students how global interactions can affect population sizes in the environment.
http://www.cnn.com/videos/world/2015/07/29/northern-white-rhino-dead-near-extinction-orig.cnn
"Silent Invasion" video. Invasive species are discussed and the role of human activity on biodiversity.
http://video.pbs.org/video/1098841639/
video on Biodiversity.
https://www.youtube.com/watch?v=-w4rI8kKKiA&feature=youtu.be

Exploration: *Student Inquiry*

Short passages about the history of species that are now extinct and the reason behind it i.e.: Tasmanian Tiger, Zanzibar Tiger and Javan Tiger.
Create a graphic organizer that separates the three terms: endangered species, threatened species, and extinct species. Students must look up the definitions of each list examples of each also.
Create a Brainstorming "POST IT" session of what factors that humans are responsible for that are harmful to the environment. Post it notes are used to display student ideas and are created in rapid successions When session is over students will organize ideas. Allows students to dispose of their ideas that seem not to fit.
Board game, students are presented with various scenarios that help them gain an appreciation for the complexities of making decisions that serve to protect rainforest lands
https://www.populationeducation.org/content/go-green-%E2%80%93-lesson-ap-environmental-science

Explanation: *Concepts and Practices*

In these lessons

- Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.
- Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.
- Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

LS2.C: Ecosystem Dynamics, Functioning, and Resilience
Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.
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.
LS4.D: Biodiversity and Humans Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate

change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (Note: This Disciplinary Core Idea is also addressed by HS-LS2-7.) ETS1.B: Developing Possible Solutions When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary) Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (secondary) ESS3.C: Human Impacts on Earth Systems The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
Elaboration: *Extension Activity* Students determine which factors to consider in deciding the fate of endangered species and prepare a short presentation on why the species should be preserved. https://www.populationeducation.org/content/ngss-lesson-plan-high-school-bye-bye-birdie
Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)* Summative : Lab worksheets, Tests, Quiz Formative : homework, classwork, exit tickets, class participation

Unit 5: : Cell Specialization and Homeostasis

Content: Cell Division, Translation and Homeostasis

Essential Questions:
How do organisms live and grow?
What are the characteristics of a living organism?

Standards:
HS-LS1-1, HS-LS1-2, HS-LS1-3, and HS-LS1-4.

Time Frame:20 days

Materials:
Modern Biology 2009; Holt Rinehart and Winston
Lab supplies
Smart board
Lap top computers
Graph paper
Colored pencils
Calculator

Content: *As a result of this learning segment, students will know…*
DNA Replication, Transcription and Translation
Hierarchy of life
Tissue types
Homeostasis andFeedback mechanisms
Mitosis
Differentiation

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- 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.
- Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
- Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Engage: *Anticipatory Set*
What is DNA and How Does it Work?
https://www.youtube.com/watch?v=zwibgNGe4aY
DNA: The Star of the Show

http://betterlesson.com/lesson/636942/dna-the-star-of-the-show
DNA Extractions
http://betterlesson.com/lesson/638562/dna-desserts
Tissue Lab
Epithelial tissues are investigated for their interconnectivity to all levels of the body
http://biologycorner.com/anatomy/histology/
Video: "How to Stop Shaking When You're Nervous"
Students will watch a video that illustrates the fight or flight response and relates it to homeostasis.
https://www.youtube.com/watch?v=yJhI0Du5jO4
Completion of "The Effect of Exercise on Homeostasis"
Students will investigate how exercise affects their breathing and heart rates, blood pressure, perspiration levels, skin color, etc.
http://gpschools.schoolwires.net/cms/lib05/MI01000971/Centricity/Domain/2027/Homeostasis%20Exercise%20Lab.pdf
Video: Cell Division and the Cell Cycle
https://www.youtube.com/watch?v=Q6ucKWIIFmg
Begin lesson by showing a 5 minute video which introduces the student to the wonder and miracle of the cell division and the cell cycle.
Students will also be shown a time lapse video showing human development from 0-14 years
Time Lapse
https://www.youtube.com/watch?v=UH1x5aRtjSQ
After showing the videos, have a class discussion about what processes were observed.
Do cells live forever? How do we grow from one cell to a complex organism?

Exploration: *Student Inquiry*
Protein Syntheis Made Simple
In this activity, students will follow the processes of DNA transcription and translation as they relate to creation of a specific protein.
http://betterlesson.com/lesson/637016/protein-synthesis-made-simple
The Monster Mash
This is lesson, students will apply the concepts of DNA transcription and translation to determine how the structure of DNA will determine the structure of proteins through hands-on student activities.
http://betterlesson.com/lesson/636975/the-monster-mash
Transcription With a Bling
In this lesson, students will transcribe and translate DNA sequences to determine the role of these processes in the creation of protein molecules.
http://betterlesson.com/lesson/636724/transcription-with-a-bling
Creating DNA's Fingerprint
In this lesson students will apply their prior knowledge of the structure and function of DNA to investigate the process of DNA fingerprinting.
http://betterlesson.com/lesson/638667/creating-dna-s-fingerprint

DNA and Genes: Virtual Lab
http://www.mhhe.com/biosci/genbio/virtual_labs_2K8/pages/DNA_And_Genes.html
Organ System Model: Heart
In cooperative groups, students will build a model that demonstrates the working mechanisms of the circulatory system. The model would include the workings of the heart, distribution and flow of blood, return of blood flow to the heart and stimulus of the heart (ie. exercise or "fight or flight" responses). Students may use any common items to construct their models.
http://www.hometrainingtools.com/a/make-a-heart-pump-science-project
Organ System Simulation: Heart Attack
Students will then navigate the following interactive activity to reinforce content mastery.
http://interactivehuman.blogspot.com/2008/10/heart-heart-information-cardiovascular.html
Organ System: Stimuli Response of the Muscle
Students will explore the relationship between a given workload on a muscle and the threshold of stimulation of the muscle.
http://www.mhhe.com/biosci/genbio/virtual_labs_2K8/pages/MuscleSimulations.html
Respiration in peas
Students will plan and conduct their own investigations about the effects water and sunlight have on root growth in pea plants.
Investigations may match the following lab outlines:
http://www.odinity.com/measuring-respiration-in-peas/
http://web.mph.net/academic/science/mvural/Life%20Science/Pea%20Plant%20Experiments.htm
Stomate response to moisture and light
Students will explore stomate response to moisture and light by designing an investigation using bean plants.
Investigations may match the following lab outlines:
http://www.biologyjunction.com/leaf_stomata_lab.htm
Mitosis onion root tip
Students are given onion root tip slides and an information sheet on the stages of mitosis. They will count the number of cells in each stage and relate it to the amount of time spent in each stage.
Online mitosis activity
http://www.biology.arizona.edu/cell_bio/activities/cell_cycle/cell_cycle.html
Karyotype fruitfly
Students will be given 4 identical fruit fly karyotypes to cut out chromosomes.
http://01.edu-cdn.com/files/static/mcgrawhillprofessional/9780071625036/CHROMOSOMES_03.GIF
Cell Differentiation Game:
http://www.letsgethealthy.org/wp-content/uploads/2013/08/Full-Lesson-Cell-differentiation-game.pdf

Explanation: *Concepts and Practices*

In these lessons

- Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.
- Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.
- Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

LS1.A: Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life.

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)

LS1.A: Structure and Function

Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.

LS1.A: Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.

LS1.B: Growth and Development of Organisms

In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.

Elaboration: *Extension Activity*

DNA and Replication

http://www.ck12.org/life-science/DNA-Structure-and-Replication-in-Life-Science/

Human Body Systems Disorder Project

http://www.ngsslifescience.com/science.php?/biology/lessonplans/C453/

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

Summative : Lab worksheets, Tests, Quiz

Formative : homework, classwork, exit tickets, class participation

Unit 6: DNA and Inheritance

Content: Molecular Biology, gene expression and Cell Division

Essential Questions:
Why do individuals of the same species vary in the way they look function and behave?
Why is variation important for the survival of the species?
Should we perform stem cell research?

Standards:
HS-LS1-4, HS-LS3-1, and HS-LS3-2.

Time Frame:20 days

Materials:
Modern Biology 2009; Holt Rinehart and Winston
Lab supplies
Smart board
Lap top computers
Graph paper
Colored pencils
Calculators

Content: *As a result of this learning segment, students will know…*
Transcription and Translation and regulation thereof.
Introns and exons
Mutations: chromosomal and Gene
Mitosis and Meiosis
Heredity and Genetics
Punnett squares
Genetic disorders
Biotechnology and transgenic
Variations in populations
Stem cells

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
- Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

- 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.

Engage: *Anticipatory Set*

Point mutation worksheet

students will read the original phrase and try to decode the three example phrases to identify the change that has been made to cause the error in the letter sequence.

Video: Cell Division and the Cell Cycle

Students will also be shown a time lapse video showing human development from 0-14 years

Time Lapse

Exploration: *Student Inquiry*

read text about the discovery of DNA and answer questions while citing textual evidence.

create models of DNA

videos, animations, programs and lectures on DNA

Transcribe DNA and translate into protein sequences.

Compare sequences of DNA and analyze mutation

Extract DNA from bananas Group students into pairs.

Gene Mutations Practice Worksheet to reinforce their understanding of the five main types of genetic mutations.

http://betterlesson.com/lesson/resource/3200970/gene-mutations-practice-ws

http://betterlesson.com/lesson/resource/3200904/genetic-mutations-lecture-notes

http://betterlesson.com/lesson/resource/3200981/gene-mutation-student-work

Mitosis Foldable

Cell Differentiation Game:

http://www.letsgethealthy.org/wp-content/uploads/2013/08/Full-Lesson-Cell-differentiation-game.pdf

Explanation: *Concepts and Practices*

In these lessons

- Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.
- Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.
- Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

LS1.A: Structure and Function

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (secondary) (Note: This Disciplinary Core Idea is also addressed by HS-LS1-1.)

LS1.B: Growth and Development of Organisms

In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.

LS3.A: Inheritance of Traits

Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.

LS3.B: Variation of Traits

In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited.

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.

Elaboration: *Extension Activity*

Stem cell Multimedia presentation

Students will research the arguments for and against stem-cell research. Review quotes from witnesses given to Congress in hearings on stem-cell research legislation. Explore questions such as: What diseases might be cured using stem-cell technology? What are some advantages and disadvantages to using adult stem cells vs. embryonic stem cells?

Students will prepare a video or multimedia presentation on one aspect of their research

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

Summative : *Lab worksheets, Tests, Quiz*

Formative : *homework, classwork, exit tickets, class participation*

Unit 7: Natural Selection

Content: Natural Selection, Adaption, Biodiversity

Essential Questions:
Why do animals go extinct?
How do genes help an organism survive?
Are all mutations Bad?

Standards:
HS-LS4-4, HS-LS4-3, HS-LS4-5, and HS-LS2-8.

Time Frame: 20 days

Materials:
Modern Biology 2009; Holt Rinehart and Winston
Lab supplies
Smart board
Lap top computers
Graph paper
Colored pencils
Calculators

Content: *As a result of this learning segment, students will know…*
Natural Selection:
over reproduction,
genetic variation,
differential reproduction
survival of the fittest
group behavior
adaption of populations
mutations
heredity

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
- Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking
- 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.

- Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.\

Engage: *Anticipatory Set*
Peppered moth online simulation
http://peppermoths.weebly.com/
Video Darwin's Finches
https://www.youtube.com/watch?v=n3265bno2X0
Video: dogs and more dogs
https://www.youtube.com/watch?v=Gz0N6-fQxcQ

Exploration: *Student Inquiry*
Peppered moth survey: Biosources lab (B9) inquiry skills
Students act as predators picking up different colored paper disks on various backgrounds
Bird adaptions lab: students examine the different characteristics of birds and match them to their environment
Sex and the single guppy
http://www.pbs.org/wgbh/evolution/sex/guppy/
Natural Selection - A Human Example
http://betterlesson.com/lesson/641940/natural-selection-a-human-example
rabbit simulation
https://phet.colorado.edu/en/simulation/natural-selection
Evolution Concept map
https://www.biologycorner.com/worksheets/evolution_concept.html
Evolution Crossword
https://www.biologycorner.com/worksheets/evolution_crossword.html

Explanation: *Concepts and Practices*
In these lessons
- Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.
- Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.
- Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

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.
The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.
LS4.C: Adaptation

Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not.
Adaptation also means that the distribution of traits in a population can change when conditions change.
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.
LS2.D: Social Interactions and Group Behavior
Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.

Elaboration: *Extension Activity*
Pogil: natural selection and evolution
Is It the End of Humanity - The Science Explanation
http://betterlesson.com/lesson/640226/is-it-the-end-of-humanity-the-science-explanation

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*
Summative : Lab worksheets, Tests, Quiz
Formative : homework, classwork, exit tickets, class participation

Unit 8: Evolution

Content: Evidence of evolution

Essential Questions:
Is the whale a closer relative to the Fish or a dog?
Why do we have structures and organs in our body that have no use.
Are humans related to yeast

Standards:
HS-LS4-1 and HS-LS4-2.

Time Frame:20 days

Materials:
Modern Biology 2009; Holt Rinehart and Winston
Lab supplies
Smart board
Lap top computers
Graph paper
Colored pencils
Calculators

Content: *As a result of this learning segment, students will know…*
Homologous and Analogous structures
Vestigial organs
Fossils and radiometric dating
Amino acid analysis
Structure vs function
Adaption

Student Learning Objective (SLO): *As a result of this learning segment, students will be able to…*

- Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
- 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.

Engage: *Anticipatory Set*
Video: Great transformations: evolution of the whale: https://www.youtube.com/watch?v=ujYNSDYIZKw

Exploration: *Student Inquiry*

Evidence of Evolution: Analogous Homologous and vestigial Structures
The Fossil Evidence for Evolution
http://www.pbslearningmedia.org/resource/tdc02.sci.life.evo.lp_fossilevid/the-fossil-evidence-for-evolution/
Fossil record; BioSource's lab (B8) Inquiry skills
Analyze characteristics of fossils to place them in similar lineage groupings. Compare the placement of fossils in rock strata to determine the relative age of fossils. Develop a model evolutionary tree based on the morphology and age of fossils.
Analyzing Amino Acid sequences to determine Evolutionary Relationships: Biosources lab (C19) laboratory techniques
Compare and contrast amino acid sequence of hemoglobin and cytochrome C and analyze evolutionary relationships

Explanation: *Concepts and Practices*
In these lessons

- Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.
- Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.
- Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

LS4.A: Evidence of Common Ancestry and Diversity
Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence.
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.
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.

Elaboration: *Extension Activity*
Index fossils and correlation lab
http://betterlesson.com/lesson/635129/index-fossils-correlation-lab

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*
Summative : Lab worksheets, Tests, Quiz
Formative : homework, classwork, exit tickets, class participation