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**SUGGESTED**

**INSTRUCTIONAL PLANNING GUIDE**

*for the Mississippi College- and Career-Readiness Standards*

**q SCIENCE**

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| **GRADE 8** |

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**INTRODUCTION**

The unprecedented, nationwide school closures in the spring of 2020 due to the COVID-19 pandemic have created a shift in how districts plan for school re-entry. Instead of the traditional brick-and-mortar planning, administrators are now identifying models that will support a variety of instructional delivery scenarios as they plan for school reopening. The traditional methods of planning and delivery are nearly impossible to implement as a stand-alone model; instead, innovative educators are developing and identifying strategies and resources to support a variety of distance learning scenarios as part of their plans. When using new models of delivery, it is important to recognize that the traditional approach to remediation—providing work better suited for earlier grades—may be insufficient. Instead, the conventional approach to remediation will likely compound the problem educators are trying to correct. According to a 2018 study, ***The Opportunity Myth***[[1]](#footnote-2), the approach of “meeting students where they are”, while often well-intended, only widens the achievement gap. Instead of remediation, teachers and administrators are encouraged to look toward acceleration methods to support student growth and close the gaps.

**PURPOSE**

The purpose of the Suggested Mississippi College- and Career-Readiness Standards Instructional Planning Guide is to provide teachers with an assistive tool for planning units of instruction. This tool will provide suggested standards grouping that should facilitate a coherent and logical delivery of related science concepts. Suggested planning sources and tools are included to assist teachers with curating instructional materials, designing and implementing effective lessons and activities, and building content knowledge and pedagogical practices. This tool encourages instructors to maintain a focus on preparing students to master skills and acquire knowledge at their current grade level.

**DEVELOPMENT**

The following suggested Instructional Planning Guide was developed with a focus on the subsequent key areas, Conceptual Connections, Real-World Connections and Phenomena, Embedded Science and Engineering Practices and Crosscutting Concepts, and Core Vocabulary. The standards are grouped into suggested units based on their underlying conceptual relationships. A list of real-world connections and/or phenomena is associated with each unit group. Their purpose is to give teachers and students researchable opportunities that lead to an in-depth and authentic quest for conceptual understanding. The embedded Science and Engineering Practices (SEPs) and Crosscutting Concepts (CCCs) are extracted from the grouped performance objectives and should encourage students to act and think like scientists. The included list of SEPs and CCCs does not indicate that other SEPs and CCCs are not relevant to the respective standard and performance objectives. Core vocabulary terms are included to emphasize terminology that is essential to the conceptual understandings captured in the standards and performance objectives. It is suggested that instructors pace themselves based on student assessment performance and demonstration of skills mastery and knowledge comprehension.

**RESOURCES for CONSIDERATION**

The resources listed below may be referenced to support classroom teachers in the development of lesson plans and instruction at the local level.   This list is not meant to be exhaustive, rather it represents consultative resources that align with the Units/Themes provided in the Instructional Planning Guides.   Educators are encouraged to use these resources in addition to those curriculum materials that meet the needs of the students they serve.

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| **High-Quality****Instructional Material** **(HQIM)** | **Planning and Instruction Resources** | **Assessment** **Resources** | **Professional Development** **Resources** |
| * [Adopted Science Texts](https://mdek12.org/OEER/Caravan)
* [STEM Teaching Tools](http://stemteachingtools.org/)
 | * [5 E Science Instructional Model](http://nextgenerationscience.weebly.com/5-es-of-science-instruction.html)
* [The Concord Consortium](https://concord.org/ngss/)
* [PBS Learning Media](https://mpb.pbslearningmedia.org/standards/0/)
* [Teacher Tube](https://www.teachertube.com/)
* [Next Generation Science Standards](https://www.nextgenscience.org/)
* [Phenomena for Next Generation Science](https://www.ngssphenomena.com/)
* [Khan Academy](https://www.khanacademy.org/)
* [OpenSciEd](https://www.openscied.org/)
* [Science Buddies](https://www.sciencebuddies.org/)
* [PhET Interactive Simulations](https://phet.colorado.edu/)
* [Phenomenal GRC Lessons](https://sites.google.com/3d-grcscience.org/going3d/home?authuser=0)
 | * [MS MAAP Program](https://mdek12.org/OSA/MAAP)
* [MS MAAP-A Program](https://mdek12.org/OSA/SP/MAAP-A)
* [Access for All Guidance](https://mdek12.org/sites/default/files/documents/OAE/OAE/2019-access-for-all-guide.pdf)
* [Problem-Attic](https://www.problem-attic.com/)
* [EDInformatics](https://www.edinformatics.com/testing/testing.htm)
* [STEM Teaching Tools for Assessments](http://stemteachingtools.org/tgs/Assessment)
* [Next Generation Science Assessment](http://nextgenscienceassessment.org/) (Middle Focus)
 | * [MDE Professional Development](https://www.mdek12.org/OPD/home)
* [The Teaching Channel](https://www.teachingchannel.com/)
* [California Academy of Sciences](https://www.calacademy.org/)
* [Teacher Tube](https://www.teachertube.com/)
* [Knowles Teacher Short Courses](https://knowlesteachers.org/knowles-academy/short-courses)
* [STEM Teaching Tools OER PD](http://stemteachingtools.org/pd)
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| **GRADE 8 SCIENCE** **THEME: Cause and Effect** |
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| **UNIT OF STUDY**(REAL-WORLD CONNECTIONS and PHENOMENA)**q** | **SCIENCE FOUNDATION STANDARDSq** | **SCIENCE AND ENGINEERING PRACTICES SCIENCE CROSSCUTTING CONCEPTS** **q** | **VOCABULARY TERMS**CORE ACADEMIC **q** |
| **COURSE INTRODUCTION**Since causes of complex phenomena and systems are not always immediately or physically visible to students, the need to develop abstract thinking skills is a significant outcome for Grade 8. Explaining patterns and making predictions based on an understanding of cause and effect allows students to conceptualize and describe the relationships among natural phenomena. In Grade 8, some examples of the relationships include the role of genetics in reproduction and heredity, the biology that explains unity anddiversity, the transfer of energy, the result of dynamic changes to the Earth’s surface, and human impact on the biosphere. | **FOUNDATION STANDARDS*** Identify and select appropriate science and engineering tools to collect, analyze, and communicate science and engineering data and information.
* Demonstrate effective questioning and observation skills
* Communicate science and engineering data using appropriate SI units of measurement
* Identify and discuss science and engineering practices
* Identify and discuss Crosscutting Concepts
 | **SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Analyze and Interpret Data
* Plan and Conduct Investigations
* Use Mathematical and Computational Thinking
* Engage in Scientific Argument from Evidence
* Construct Explanations and Design Solutions
* Obtain, Evaluate, and Communicate Information

**SCIENCE CROSSCUTTING CONCEPTS*** Patterns
* Cause and Effect *(Mechanism and Explanation)*
* Scale, Proportion, and Quantity
* Systems and System Models
* Energy and Matter *(Flows, Cycles, Conservation)*
* Structure and Function
* Stability and Change
 | Argument ChangeConcepts DataDependent Variable Engineering Evaluate Evidence Gram Independent Variable InterpretInvestigationLiter Meter Observation Patterns QuantityScience  SI Units of Measurement Stability |

| **TERM 1** |
| --- |
| **UNIT OF STUDY**(REAL-WORLD CONNECTIONS and PHENOMENA)**q** | **MS CCR STANDARDSq** | **SCIENCE AND ENGINEERING PRACTICES SCIENCE CROSSCUTTING CONCEPTS** **q** | **VOCABULARY TERMS**CORE ACADEMIC **q** |
| **EARTH’S STRUCTURE and HISTORY:****History of Earth****REAL-WORLD CONNECTIONS and PHENOMENA*** Examine various types of rocks and their impacts on the agricultural industry.
* Research the rock cycle and how this cycle affects changes in the earth’s surface.
 | **E.8.7 Students will demonstrate an understanding of geological evidence to analyze patterns in Earth’s major events, processes, and evolution in history.****E.8.7.1** Use scientific evidence to create a timeline of Earth’s history that depicts relative dates from index fossil records and layers of rock (strata). **E.8.7.2** Create a model of the processes involved in the rock cycle and relate it to the fossil record.**E.8.7.3** Construct and analyze scientific arguments to support claims that most fossil evidence is an indication of the diversity of life that was present on Earth and that relationships exist between past and current life forms.**E.8.7.4** Use research and evidence to document how evolution has been shaped both gradually and through mass extinction by Earth’s varying geological conditions (e.g., climate change, meteor impacts, and volcanic eruptions). | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Analyze and Interpret Data
* Engage in Scientific Argument from Evidence
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Cause and Effect *(Mechanism and Explanation)*
* Systems and System Models
* Structure and Function
* Stability and Change
 | *Absolute Geological Dating*Cambrian PeriodCenozoic EraCretaceous Period*Geological Time Scale*HoloceneIgneous RockIndex FossilMetamorphic RockMolten RockPaleozoic EraQuaternary PeriodRock StratumTertiary Period |
| **EARTH’S SYSTEMS and CYCLES****Plate Tectonics****REAL-WORLD CONNECTIONS and PHENOMENA*** Discuss the history of volcanoes in Mississippi and how they have affected conditions in our state today.
* Research the area known as Woodall Mountain, the highest point in Mississippi, and theories of formation.
 | **E.8.9A Students will demonstrate an understanding that physical processes and major geological events (e.g., plate movement, volcanic activity, mountain building, erosion, weathering) are powered by the Sun and the Earth’s internal heat and have occurred over millions of years.****E.8.9A.1** Investigate and explain how the flow of Earth’s internal energy drives the cycling of matter through convection currents between Earth’s surface and the deep interior causing plate movements.**E.8.9A.2** Explore and debate theories of plate tectonics to form conclusions about past and current movements of rocks at Earth’s surface throughout history.**E.8.9A.3** Map land and water patterns from various time periods and use rocks and fossils to report evidence of how Earth’s plates have moved great distances, collided, and spread apart.**E.8.9A.4** Research and assess the credibility of scientific ideas to debate and discuss how Earth’s constructive and destructive processes have changed Earth’s surface at varying time and spatial scales. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Analyze and Interpret Data
* Plan and Conduct Investigations
* Engage in Scientific Argument from Evidence
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Cause and Effect *(Mechanism and Explanation)*
* Scale, Proportion, and Quantity
* Energy and Matter *(Flows, Cycles, Conservation)*
* Structure and Function
* Stability and Change
 | Asthenosphere*Convergent Boundary**Divergent Boundary**Geoscience Process*LithosphereMid-Ocean RidgePlate BoundaryPlate TectonicsTopography*Transform Boundary* |
| **EARTH’S SYSTEMS and CYCLES****Geological Events****REAL-WORLD CONNECTIONS and PHENOMENA*** Examine and discuss what part erosion has played in the pollution of local water systems.
 | **E.8.9A Students will demonstrate an understanding that physical processes and major geological events (e.g., plate movement, volcanic activity, mountain building, erosion, weathering) are powered by the Sun and the Earth’s internal heat and have occurred over millions of years.****E.8.9A.5** Use models that demonstrate convergent and divergent plate movements that are responsible for most landforms and the distribution of most rocks and minerals within Earth’s crust.**E.8.9A.6** Design and conduct investigations to evaluate the chemical and physical processes involved in the formation of soils.**E.8.9A.7** Explain the interconnected relationship between surface water and groundwater. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Plan and Conduct Investigations
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Cause and Effect *(Mechanism and Explanation)*
* Energy and Matter *(Flows, Cycles, Conservation)*
* Stability and Change
 | WeatheringErosionMineralsSurface WaterGround WaterTopographyLithosphereAsthenosphere |

| **TERM 2** |
| --- |
| **UNIT OF STUDY**(REAL-WORLD CONNECTIONS and PHENOMENA)**q** | **MS CCR STANDARDSq** | **SCIENCE AND ENGINEERING PRACTICES  SCIENCE CROSSCUTTING CONCEPTS** **q** | **VOCABULARY TERMS**CORE ACADEMIC **q** |
| **EARTH’S SYSTEMS and CYCLES****Natural Hazards****REAL-WORLD CONNECTIONS and PHENOMENA*** Discuss the Long-term economic impact of natural hazards such as earthquakes, volcanic eruptions, and dangerous weather conditions.
* Examine local, state, and federal responses to natural disasters and devise plans for more effective response mechanisms.
 | **E.8.9B Students will demonstrate an understanding of natural hazards (volcanic eruptions, severe weather, earthquakes) and construct explanations for why some hazards are predictable and others are not.****E.8.9B.1** Research and map various types of natural hazards to determine their impact on society.**E.8.9B.2** Compare and contrast technologies that predict natural hazards to identify which types of technologies are most effective.**E.8.9B.3** Using an engineering design process, create mechanisms to improve community resilience, which safeguard against natural hazards (e.g., building restrictions in flood or tidal zones, regional watershed management, Firewise construction). \* **All SEPs and CCCs are applicable.** | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Analyze and Interpret Data
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Cause and Effect *(Mechanism and Explanation)*
* Energy and Matter *(Flows, Cycles, Conservation)*
* Structure and Function
* Stability and Change
 | AtmosphereEarthquakeGeological EventGeosphereHazardous WeatherHydrosphere*Large-Scale System Interactions*Natural HazardVolcanic Eruption |
| **EARTH’S SYSTEMS and CYCLES****Environmental Impacts by Humans****REAL-WORLD CONNECTIONS and PHENOMENA*** Investigate the relationship between deforestation and climate change.
* Research and report on the Impact of recycling initiatives in local communities.
 | **E.8.10 Students will demonstrate an understanding that a decrease in natural resources indirectly related to the increase in human population on Earth and must be conserved.****E.8.10.1** Read and evaluate scientific information about advancements in renewable and nonrenewableresources. Propose and defend ways to decrease national and global dependency on nonrenewable resources.**E.8.10.2** Create and defend a proposal for reducing the environmental effects humans have on Earth (e.g., population increases, consumer demands, chemical pollution, deforestation, and change in average annual temperature).**E.8.10.3** Using scientific data, debate the societal advantages and disadvantages of technological advancements in renewable energy sources.**E.8.10.4** Using an engineering design process, develop a system to capture and distribute thermal energy that makes renewable energy more readily available and reduces human impact on the environment (e.g., building solar water heaters, conserving home energy). \* **All SEPs and CCCs are applicable.** | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Analyze and Interpret Data
* Plan and Conduct Investigations
* Engage in Scientific Argument from Evidence
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Cause and Effect *(Mechanism and Explanation)*
* Systems and System Models
* Energy and Matter *(Flows, Cycles, Conservation)*
* Stability and Change
 | ConservationEnvironmentHuman ActivityNatural ResourcesNonrenewableOrganic MaterialPollutionRecyclingRenewableWaste |
| **MOTIONS, FORCES, and ENERGY****Properties of Waves****REAL-WORLD CONNECTIONS and PHENOMENA*** Research and discuss how ocean waves are used to capture electrical energy.
* Discuss the usefulness of wave properties in the telecommunications industry.
 | **P.8.6 Students will demonstrate an understanding of the properties, behaviors, and application of waves.****P.8.6.1** Collect, organize, and interpret data about the characteristics of sound and light waves to construct explanations about the relationship between matter and energy.**P.8.6.2** Investigate research-based mechanisms for capturing and converting wave energy (frequency, amplitude, wavelength, and speed) into electrical energy.**P.8.6.3** Conduct simple investigations about the performance of waves to describe their behavior (e.g., refraction, reflection, transmission, and absorption) as they interact with various materials (e.g., lenses, mirrors, and prisms).**P.8.6.7** Research the historical significance of wave technology to explain how digitized tools have evolved to encode and transmit information (e.g., telegraph, cell phones, and wireless computer networks). | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Analyze and Interpret Data
* Plan and Conduct Investigations
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Scale, Proportion, and Quantity
* Energy and Matter *(Flows, Cycles, Conservation)*
* Stability and Change
 | AbsorptionAmplitudeCrestFrequencyReflectionRefractionSpeedTransmissionTroughWavelength |
| **MOTIONS, FORCES, and ENERGY****Types Behaviors and Applications of Waves****REAL-WORLD CONNECTIONS and PHENOMENA*** Research the mechanics behind invisibility cloaking as they apply to manipulating light waves. Search for military initiatives in this effort.
* Examine how sound waves are used in studying and communicating in aquatic biomes.
 | **P.8.6 Students will demonstrate an understanding of the properties, behaviors, and application of waves.****P.8.6.4** Use scientific processes to plan and conduct controlled investigations to conclude sound is a wave phenomenon that is characterized by amplitude and frequency.**P.8.6.5** Conduct scientific investigations that describe the behavior of sound when resonance changes (e.g., waves in a stretched string and design of musical instruments).**P.8.6.6** Obtain and evaluate scientific information to explain the relationship between seeing color and the transmission, absorption, or reflection of light waves by various materials.**P.8.6.8** Compare and contrast the behavior of sound and light waves to determine which types of waves need a medium for transmission. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Analyze and Interpret Data
* Plan and Conduct Investigations
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Scale, Proportion, and Quantity
* Energy and Matter *(Flows, Cycles, Conservation)*
* Stability and Change
 | Digitized SignalsInfrared WavesLight WavesLoudnessMicrowavesRadio WavesSound WaveSpectrumWave Speed |

| **TERM 3** |
| --- |
| **UNIT OF STUDY**(REAL-WORLD CONNECTIONS and PHENOMENA)**q** | **MS CCR STANDARDSq** | **SCIENCE AND ENGINEERING PRACTICES SCIENCE CROSSCUTTING CONCEPTS** **q** | **VOCABULARY TERMS**CORE ACADEMIC **q** |
| **REPRODUCTION and HEREDITY****Asexual Reproduction****REAL-WORLD CONNECTIONS and PHENOMENA*** Research and discuss asexual reproduction and genetic engineering.
* Research and discuss asexual reproduction and the farming industry.
 | **L.8.2A Students will demonstrate an understanding of how sexual reproduction results in offspring with genetic variation while asexual reproduction results in offspring with identical genetic information.****L.8.2A.1** Obtain and communicate information about the relationship of genes, chromosomes, and DNA, and construct explanations comparing their relationship to inherited characteristics.**L.8.2A.2** Create a diagram of mitosis and explain its role in asexual reproduction, which results in offspring with identical genetic information.  | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Structure and Function
* Stability and Change
 | *Asexual Reproduction*Binary FissionBuddingChromosomeFungiMitosisOffspring*Sexual Reproduction*Vegetative Propagation |
| **REPRODUCTION and HEREDITY****Sexual Reproduction****REAL-WORLD CONNECTIONS and PHENOMENA*** Research genetic diversity and disease resistance in organisms.
* Discuss how the bumblebee population impacts sexual reproduction of flowering plants.
 | **L.8.2A Students will demonstrate an understanding of how sexual reproduction results in offspring with genetic variation while asexual reproduction results in offspring with identical genetic information.****L.8.2A.3** Construct explanations of how genetic information is transferred during meiosis.**L.8.2A.4** Engage in discussion using models and evidence to explain that sexual reproduction produces offspring that have a new combination of genetic information different from either parent.**L.8.2A.5** Evaluate advantages and disadvantages of asexual and sexual reproduction. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Analyze and Interpret Data
* Construct Explanations and Design Solutions
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Systems and System Models
* Structure and Function
* Stability and Change
 | AllelesChromosomeDominantGenetic VariationMeiosisOffspringRecessive*Sexual Reproduction* |
| **REPRODUCTION and HEREDITY****Genetics** **REAL-WORLD CONNECTIONS and PHENOMENA*** Gather various forms of text and discuss how genetic information is being used in early disease detection.
* Research how genetic information is manipulated to increase crop yields.
 | **L.8.2B Students will demonstrate an understanding of the differences in inherited and acquired characteristics and how environmental factors (natural selection) and the use of technologies (selective breeding, genetic engineering) influence the transfer of genetic information.****L.8.2B.2** Use various scientific resources to research and support the historical findings of Gregor Mendel to explain the basic principles of heredity.**L.8.2B.3** Use mathematical and computational thinking to analyze data and make predictions about the outcome of specific genetic crosses (monohybrid Punnett Squares) involving simple dominant/recessive traits. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Use Mathematical and Computational Thinking
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Structure and Function
 | AlleleDominant TraitGenotypeHeredityHeterozygousHomozygousPhenotypePunnett SquareRecessive Trait |

| **TERM 4** |
| --- |
| **UNIT OF STUDY**(REAL-WORLD CONNECTIONS and PHENOMENA)**q** | **MS CCR STANDARDSq** | **SCIENCE AND ENGINEERING PRACTICES SCIENCE CROSSCUTTING CONCEPTS** **q** | **VOCABULARY TERMS**CORE ACADEMIC **q** |
| **REPRODUCTION and HEREDITY****Natural and Artificial Selection** **REAL-WORLD CONNECTIONS and PHENOMENA*** Research and discuss ethical concerns around genetically modified organisms to include agriculture and designer pets, human cloning.
* Research methods of gene regulation to include CRISPR.
 | **L.8.2B Students will demonstrate an understanding of the differences in inherited and acquired characteristics and how environmental factors (natural selection) and the use of technologies (selective breeding, genetic engineering) influence the transfer of genetic information.****L.8.2B.1** Construct an argument based on evidence for how environmental and genetic factors influence the growth of organisms.**L.8.2B.4** Debate the ethics of artificial selection (selective breeding, genetic engineering) and the societal impacts of humans changing the inheritance of desired traits in organisms. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Plan and Conduct Investigations
* Engage in Scientific Argument from Evidence
* Construct Explanations and Design Solutions
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Cause and Effect *(Mechanism and Explanation)*
* Stability and Change
 | Artificial SelectionEvolutionFavorable TraitGenesGenetic EngineeringGenotypeInherited CharacteristicsNatural SelectionPedigreePhenotypeSelective BreedingTraitVariation |
| **REPRODUCTION and HEREDITY****Genetic Mutations****REAL-WORLD CONNECTIONS and PHENOMENA*** Research and identify diseases and conditions caused by genetic mutations.
* Examine case studies featuring methods used to correct genetic mutations.
 | **L.8.2C Students will demonstrate an understanding that chromosomes contain many distinct genes and that each gene holds the instructions for the production of a specific protein, which in turn affects the traits of an individual.****L.8.2C.1** Communicate through diagrams that chromosomes contain many distinct genes and that each gene holds the instructions for the production of specific proteins, which in turn affects the traits of the individual (not to include transcription or translation).**L.8.2C.2** Construct scientific arguments from evidence to support claims about the potentially harmful, beneficial, or neutral effects of genetic mutations on organisms. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Analyze and Interpret Data
* Engage in Scientific Argument from Evidence
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Cause and Effect *(Mechanism and Explanation)*
* Structure and Function
* Stability and Change
 | ProteinsMutationChromosomeGeneGene PoolProteinEvolutionary HistoryVariation |
| **ADAPTATION and DIVDERSITY****Adaptation and Natural Selection****REAL-WORLD CONNECTIONS and PHENOMENA*** Examine the case study of [rabbit and viruses](https://www.virology.ws/2019/03/21/rabbits-and-viruses-an-iconic-example-of-natural-selection/). An attempt to control rabbit populations in Australia.
* Examine case from Darwin’s study of finches analyzing his theory of genetic drift and natural selection.
 | **L.8.4A Students will demonstrate an understanding of the process of natural selection, in which variations in a population increase some individuals’ likelihood of surviving and reproducing in a changing environment.****L.8.4A.1** Use various scientific resources to analyze the historical findings of Charles Darwin to explain basic principles of natural selection.**L.8.4A.2** Investigate to construct explanations about natural selection that connect growth, survival, and reproduction to genetic factors, environmental factors, food intake, and interactions with other organisms. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Questions and Define Problems
* Plan and Conduct Investigations
* Construct Explanation and Design Solutions
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Cause and Effect *(Mechanism and Explanation)*
* Structure and Function
* Stability and Change
 | Natural SelectionPopulationVariationFavorable TraitsTheory of Evolution |
| **ADAPTATION and DIVDERSITY****Common Ancestry****REAL-WORLD CONNECTIONS and PHENOMENA*** Research speciation in African cichlids
* Discuss evolutionary relationships between modern and pre-historic reptiles
* Research genetic variation and human immuno-response to diseases such as COVID-19
 | **L.8.4B Students will demonstrate an understanding of how similarities and differences among living and extinct species provide evidence that changes have occurred in organisms over time and that similarity of characteristics provides evidence of common ancestry.****L.8.4B.1** Analyze and interpret data (e.g. pictures, graphs) to explain how natural selection may lead to increases and decreases of specific traits in populations over time.**L.8.4B.2** Construct written and verbal explanations to describe how genetic variations of traits in a population increase some organisms’ probability of surviving and reproducing in a specific environment.**L.8.4B.3** Obtain and evaluate scientific information to explain that separated populations, that remain separated, can evolve through mutations to become a new species (speciation).**L.8.4B.4** Analyze displays of pictorial data to compare embryological and homologous/analogous structures across multiple species to identify evolutionary relationships. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES*** Ask Question and Define Problems
* Develop and Use Models
* Analyze and Interpret Data
* Engage in Scientific Argument from Evidence
* Obtain, Evaluate, and Communicate Information

**EMBEDDED CROSSCUTTING CONCEPTS*** Patterns
* Cause and Effect *(Mechanism and Explanation)*
* Scale, Proportion, and Quantity
* Structure and Function
* Stability and Change
 | Adaptation*Analogous Structures*Common Ancestry*Embryological Structures*GenerationGeneric Variation*Homologous Structures*Natural SelectionPopulationSpeciation |

1. https://tntp.org/assets/documents/TNTP\_The-Opportunity-Myth\_Web.pdf [↑](#footnote-ref-2)