SUBJECT: Zoology

BOE APPROVAL: August 2020

Cliffside Park Public Schools

GRADE: 11-12

Zoology

All standards are NJSLS-S

SUBJECT: Zoology **GRADE: 11-12**

Cliffside Park Public Schools

BOE APPROVAL: August 2020

Unit 1: Classification

Grade: 11-12

Content Area: Life Science

Pacing: 7 Instructional Days

Essential Questions

- What characteristics do living things have that enable them to be classified?
- How has the Linnaeus system of classification allowed for the easy sorting of living things?

Student Learning Objectives (Performance Expectations NJSLS-S)

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Unit Summary

All life has been scientifically organized and arranged in taxonomic categories, determined by characteristics in common. This system, introduced by Linnaeus, utilized the latin language to assign all living things unique and specific two part names. Binomial nomenclature, in tandem with the taxonomic categories, allowed for organization from the all inclusive, to the very specific.

Technical Terms

Taxonomy, Kingdom, Phyla, Class, Order, Family, Genus, Species

Disciplinary Core Ideas:	**Crosscutting Concepts:**	**Science and Engineering Practices:**
▪ Genetic information 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. (NJSLS-S-HS-LS4-1)	▪ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (NJSLS-S-HS-LS4-1) ---------- ***Connections to Nature of Science***	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ▪ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (NJSLS-S-HS-LS4-1)

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

▪ 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. (NJSLS-S-HS-LS4-2) **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. (NJSLS-S-HS-LS4-2) ▪ 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. (NJSLS-S-HS-LS4-4) ▪ 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. (NJSLS-S-HS-LS4-5) ▪ 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. (NJSLS-S-HS-LS4-5)	**Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-1) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-2) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-4) **----------** ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-4) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-5)	**----------** ***Connections to Nature of Science*** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ▪ A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (NJSLS-S-HS-LS4-1) ▪ Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (NJSLS-S-HS-LS4-2) Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-4) Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

		critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in science. ▪ Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (NJSLS-S-HS-LS4-5)

Formative Assessment Measures

Part A: Why are certain living organisms grouped together in certain taxonomic categories?

Students who understand the concepts are able to:

- Construct and revise an explanation for the placement of organisms in particular taxonomic categories, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that the characteristics in common led to those selections.

Part B: How can a new trait change the appropriate classification of a living thing?

Students who understand the concepts are able to:

- Construct and revise an explanation for the change in taxonomic category for a living thing, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that the change in characteristics made the new organism different from the original ancestor.

Part C: How can the system of classification be utilized for different goals and objectives around the world?

- Construct and revise an argument for the importance of the system utilized, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories and simulations) and the assumption that the system in question is used world-wide.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
• Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. RST.11-12.1 (HS-LS4-1 through 5) • Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. SL.11-12.5 (HS-4-1 through 5)	• Reason abstractly and quantitatively. MP.2 (HS-L4-1) • Model with mathematics. MP.4 (HS-LS4-1)

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.B.1,

Modifications

English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication	Curriculum compacting Challenge assignments Enrich ment activities Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Think-pair- share Visual aides Modeling Cognates	Answer masking Answer eliminator Highlighter Color contrast	Modified assignments Counseling	Critical/Analytical thinking tasks Self-directed activities

SUBJECT: Zoology **GRADE: 11-12**

Cliffside Park Public Schools

BOE APPROVAL: August 2020

Unit 2: Introduction to the Animal Kingdom

Grade: 11-12

Content Area: Life Science

Pacing: 7 instructional days

Essential Questions

- What characteristics do all animals share?
- What essential life functions do animals carry out?
- What are the important trends in animal evolution?

Student Learning Objectives (Performance Expectations NJSLS-S)

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Unit Summary

Out of the six kingdoms, the animal kingdom is the most evolved and thus the most complicated. Characteristics that are unique to only this group of animals such as specific germ tissue layers and their complexity through evolution are studied as preparatory information for future units and concepts.

Technical Terms

Invertebrate, Vertebrate, Blastula, Protostome, Deuterostome, Anus, Endoderm, Mesoderm, Ectoderm, Radial Symmetry, Bilateral Symmetry, Cephalization

Disciplinary Core Ideas:

- 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. (NJSLS-S-HS-LS4-1)
  - 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

Crosscutting Concepts:

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (NJSLS-S-HS-LS4-1)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Scientific knowledge is based on the assumption that natural laws operate today

Science and Engineering Practices:

Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

- Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (NJSLS-S-HS-LS4-1)

Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

performance among individuals. (NJSLS-S-HS-LS4-2) **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. (NJSLS-S-HS-LS4-2) ▪ 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. (NJSLS-S-HS-LS4-4) ▪ 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. (NJSLS-S-HS-LS4-5) ▪ 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. (NJSLS-S-HS-LS4-5)	as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-1) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-2) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-4) **----------** ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-4) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-5)	▪ A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (NJSLS-S-HS-LS4-1) ▪ Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (NJSLS-S-HS-LS4-2) Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-4) Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in science. ▪ Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (NJSLS-S-HS-LS4-5)

Formative Assessment Measures
Part A: How do animals develop their germ layers during development?
Students who understand the concepts are able to: ● Construct and revise an explanation for the embryonic development of animal species, based on the reproduction type and complexity of the developing body, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that

SUBJECT: Zoology **Cliffside Park Public Schools** **GRADE: 11-12**

BOE APPROVAL: August 2020

theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Part B: How does an animal's physiology differ from that of other living organisms?

Students who understand the concepts are able to:

- Construct and revise an explanation for the physiological differences between animals and the other kingdoms, starting from the cellular and organ level, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future..

Part C: How do the advanced animals show evolutionary development?

Students who understand the concepts are able to:

- Construct and revise an explanation for the appearance of critical characteristics and adaptations at different moments across the timeline of evolution, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future..

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
• Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. RST.11-12.1 (HS-LS4-1, 4-2, 4-4) • Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. SL.11-12.5 (HS-LS4-2)	• Reason abstractly and quantitatively. MP.2 (HS-LS4-2) • Model with mathematics. MP.4 (HS-LS4-2) • Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN-Q.A.1 (HS-LS4-2) • Define appropriate quantities for the purpose of descriptive modeling. HSN-Q.A.2 (HS-LS4-2) • HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS4-2)

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.B.1,

Modifications

English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair- share Visual aides Modeling Cognates	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication Modified assignments Counseling	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities

SUBJECT: Zoology **GRADE: 11-12**

BOE APPROVAL: August 2020

Cliffside Park Public Schools

Unit 3: Porifera and Cnidaria

Grade: 11-12

Content Area: Life Science

Pacing: 7 instructional days

Essential Questions

- Why are sponges considered animals?
- How do sponges carry out essential life functions?
- What is a cnidarian?
- How is the body plan seen in the Cnidarian body?

Student Learning Objectives (Performance Expectations NJSLS-S)

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Unit Summary

Poriferans are the simplest of animals, possessing only cellular organization and displaying no symmetry,
Cnidarians are also simple animals, however the concept of symmetry is introduced in their body design and evolutionary adaptations are seen and introduced as a pattern to be repeated as the course continues. (Cnidarians have a specialized cell for obtaining food)

Technical Terms

Choanocyte, Osculum, Spicule, Archaeocyte, Larva, Cnidocyte, Polyp, Medusa, Gastrovascular Cavity, Nerve Net, Hydrostatic Skeleton

Disciplinary Core Ideas:	**Crosscutting Concepts:**	**Science and Engineering Practices:**
▪ 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. (NJSLS-S-HS-LS4-1) ▪ Natural selection occurs only if there is both (1) variation in the genetic information between	▪ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (NJSLS-S-HS-LS4-1) ---------- ***Connections to Nature of Science***	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ▪ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (NJSLS-S-HS-LS4-1) ----------

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

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SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Formative Assessment Measures
Part A: Why are sponges considered animals?
Students who understand the concepts are able to: ● Construct and revise an explanation for the acceptance of sponges as animals, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Part B: How do Cnidarians show basic evolution steps from the Sponge?
Students who understand the concepts are able to: ● Construct and revise an explanation for the presence of evolution and the anatomical changes seen in Cnidarians, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Part C: How does symmetry appear in the Animal Kingdom?
● Construct and revise an explanation for the appearance of body symmetry and its importance,, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Interdisciplinary Connections	
NJSLS- ELA	NJSLS- Mathematics
● Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. RST.11-12.1 (HS-LS2-3) ● Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. SL.11-12.5 (HS-LS1-5)	● Reason abstractly and quantitatively. MP.2 (HS-LS2-4) ● Model with mathematics. MP.4 (HS-LS2-4) ● Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN-Q.A.1 (HS-LS2-4) ● Define appropriate quantities for the purpose of descriptive modeling. HSN-Q.A.2 (HS-LS2-4) ● HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-4)

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.B.1,

Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication Modified assignments	Curriculum compacting Challenge assignments Enrich ment activities Tiered activities Independent research/inquiry Collaborative teamwork

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Annotation guides Think-pair- share Visual aides Modeling Cognates	Extended time Answer masking Answer eliminator Highlighter Color contrast	Counseling	Higher level questioning Critical/Analytical thinking tasks Self-directed activities

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Unit 4: Worms (Platyhelminthes, Nematoda, Annelida)
Grade: 11-12
Content Area: Life Science
Pacing: 11 instructional days
Essential Questions
- What are the defining features of the Flatworms? - What are the defining features of the Roundworms? - What are the defining features of the Annelid worms? - How has each worm group become more advanced and evolved, and what structures or body features have helped with that process?
Student Learning Objectives (Performance Expectations NJSLS-S)
HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations. HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
Unit Summary
The term “worm” is a loosely applied term to a group of bilateral invertebrates without appendages. There are many types of worms and not all of them exhibit traditional worm behavior. They may be parasitic or free living, aquatic or terrestrial and come in three different forms: round, segmented and flat. Worms are the first animals studied that have bilateral symmetry and full organs that lead to body organ systems.
Technical Terms
Acoelomate, Coelom, Pharynx, Flame Cell, Ganglion, Eye Spot, Hermaphrodite, Fission, Scolex, Proglottid, Testis, Pseudocoelom, Anus, Septum, Seta, Crop, Gizzard, Nephridium, Clittelum

Disciplinary Core Ideas:	**Crosscutting Concepts:**	**Science and Engineering Practices:**
▪ 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. (NJSLS-S-HS-LS4-1) ▪ 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,	▪ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (NJSLS-S-HS-LS4-1) --- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems**	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ▪ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (NJSLS-S-HS-LS4-1) --- ***Connections to Nature of Science***

SUBJECT: Zoology **Cliffside Park Public Schools** **GRADE: 11-12**

BOE APPROVAL: August 2020

trait variation—that leads to differences in performance among individuals. (NJSLS-S-HS-LS4-2) **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. (NJSLS-S-HS-LS4-2) ▪ 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. (NJSLS-S-HS-LS4-4) ▪ 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. (NJSLS-S-HS-LS4-5) ▪ 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. (NJSLS-S-HS-LS4-5)	▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-1) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-2) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-4) ---------- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-4) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-5)	**Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ▪ A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (NJSLS-S-HS-LS4-1) ▪ Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (NJSLS-S-HS-LS4-2) Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-4) Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in science. ▪ Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (NJSLS-S-HS-LS4-5)

Formative Assessment Measures
Part A: How is a worm's body design a sign of how the worm survives and functions in its environment?
Students who understand the concepts are able to: ● Construct and revise an explanation for the body plan and design of a worm, compared to the survival techniques and feeding habits of the organism, based on valid and

SUBJECT: Zoology **Cliffside Park Public Schools** **GRADE: 11-12**

BOE APPROVAL: August 2020

reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Part B: Why do parasitic worms have different body development and body structure?

Students who understand the concepts are able to:

- Construct and revise an explanation for the behavior and body adaptations for parasitic worms, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Part C: How do worms show the first evolution steps to working organs and organ systems?

Students who understand the concepts are able to:

- Construct and revise an explanation for the appearance of certain tissue and cell layers, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
• Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. RST.11-12.1 (HS-LS2-3) • Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. SL.11-12.5 (HS-LS1-5)	• Reason abstractly and quantitatively. MP.2 (HS-LS2-4) • Model with mathematics. MP.4 (HS-LS2-4) • Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN-Q.A.1 (HS-LS2-4) • Define appropriate quantities for the purpose of descriptive modeling. HSN-Q.A.2 (HS-LS2-4) • HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-4)

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.B.1,

Modifications

English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	communication	Higher level questioning
Annotation guides	Extended time	Modified assignments	Critical/Analytical thinking tasks
Think-pair- share	Answer masking	Counseling	Self-directed activities
Visual aides	Answer eliminator		
Modeling	Highlighter		
Cognates	Color contrast		

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Unit 5: Mollusca
Grade: 11-12
Content Area: Life Science
Pacing: 6 instructional days
Essential Questions
- What are the defining characteristics of a mollusk? - What is the basic body plan of a mollusk? - How has evolution impacted the different Classes within the Mollusca phylum?
Student Learning Objectives (Performance Expectations NJSLS-S)
HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations. HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
Unit Summary
Mollusks are soft bodied invertebrates that possess body symmetry and more evolved body systems. They are a bridge between the worms studied previously and the Arthropods that are to follow. These animals offer insight into new adaptations that are possible, such as camouflage, body armor protection, and new feeding techniques.
Technical Terms
Shell, Trochophore, Foot, Mantle, Visceral Mass, Foot, Tentacles, Radula, Gills, Siphon

Disciplinary Core Ideas:	**Crosscutting Concepts:**	**Science and Engineering Practices:**
▪ 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. (NJSLS-S-HS-LS4-1) ▪ 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,	▪ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (NJSLS-S-HS-LS4-1) --- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an**	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ▪ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (NJSLS-S-HS-LS4-1) --- ***Connections to Nature of Science***

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

trait variation—that leads to differences in performance among individuals. (NJSLS-S-HS-LS4-2) **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. (NJSLS-S-HS-LS4-2) ▪ 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. (NJSLS-S-HS-LS4-4) ▪ 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. (NJSLS-S-HS-LS4-5) ▪ 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. (NJSLS-S-HS-LS4-5)	**Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-1) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-2) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-4) --- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-4) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-5)	**Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ▪ A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (NJSLS-S-HS-LS4-1) ▪ Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (NJSLS-S-HS-LS4-2) Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-4) Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in science. ▪ Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (NJSLS-S-HS-LS4-5)
Formative Assessment Measures		

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Part A: How do Mollusks show evolutionary trends with the worms, and then with the Arthropods?
Students who understand the concepts are able to: ● Construct and revise an explanation for the physical and physiological similarities and differences from an evolution standpoint between the three invertebrate groups, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural
Part B: How does the Mollusk body show evolution and development?
Students who understand the concepts are able to: ● Construct and revise an explanation for the changes to the physical body of the animal group, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural
Part C: How does the Mollusk group show the ranges in diversity based on the different Orders?
Students who understand the concepts are able to: ● Construct and revise an explanation for the diversity in the group of animals, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural

Interdisciplinary Connections	
NJSLS- ELA	NJSLS- Mathematics
● Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. RST.11-12.1 (HS-LS2-3) ● Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. SL.11-12.5 (HS-LS1-5)	● Reason abstractly and quantitatively. MP.2 (HS-LS2-4) ● Model with mathematics. MP.4 (HS-LS2-4) ● Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN-Q.A.1 (HS-LS2-4) ● Define appropriate quantities for the purpose of descriptive modeling. HSN-Q.A.2 (HS-LS2-4) ● HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-4)

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.B.1,

Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Think-pair- share Visual aides Modeling Cognates	Answer masking Answer eliminator Highlighter Color contrast		Self-directed activities

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Unit 6: Arthropoda

Grade: 11-12

Content Area: Life Science

Pacing: 7 instructional days

Essential Questions

- How are arthropods classified?
- What are the distinguishing features of the different Classes of Arthropoda?
- What are the distinguishing features of the insects?
- How have insects become so successful and diverse?

Student Learning Objectives (Performance Expectations NJSLS-S)

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Unit Summary

Arthropods are the most evolved and most successful of all the invertebrates. The presence of their exoskeleton plus the ability to adapt and survive well in any environmental condition (except the cold) has allowed them to spread around the world and become successful. Arthropods take all of the evolutionary progress studied so far and incorporate all of the features into their survival, in addition to extra adaptations, body features, and characteristics.

Technical Terms

Exoskeleton, Chitin, Tracheal Tube, Spiracle, Book Lung, Malpighian Tube, Molting, Cephalothorax, Thorax, Abdomen, Carapace, Mandible, Cheliped, Swimmeret, Chelicera, Pedipalp, Spinneret, Nymph, Pupa, Caste

Disciplinary Core Ideas:	**Crosscutting Concepts:**	**Science and Engineering Practices:**
▪ 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. (NJSLS-S-HS-LS4-1)	▪ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (NJSLS-S-HS-LS4-1) --- ***Connections to Nature of Science***	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ▪ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (NJSLS-S-HS-LS4-1) ---

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

▪ 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. (NJSLS-S-HS-LS4-2) **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. (NJSLS-S-HS-LS4-2) ▪ 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. (NJSLS-S-HS-LS4-4) ▪ 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. (NJSLS-S-HS-LS4-5) ▪ 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. (NJSLS-S-HS-LS4-5)	**Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-1) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-2) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-4) --- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. 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Arguments may also come from current or historical episodes in science. ▪ Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (NJSLS-S-HS-LS4-5)

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Formative Assessment Measures
Part A: Why are Arthropods so successful?
Students who understand the concepts are able to: ● Construct and revise an explanation for the success of the Phylum, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Part B: How is Arthropod Diversity increased from earlier studies?
Students who understand the concepts are able to: ● Construct and revise an explanation for the diversity found in the Arthropod body,, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Part C: How have developed systems and tissue layers become more advanced?
Students who understand the concepts are able to: ● Construct and revise an explanation for the development of the Arthropod body, organs, and tissue layers, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Interdisciplinary Connections	
NJSLS- ELA	NJSLS- Mathematics
● Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. RST.11-12.1 (HS-LS2-3) ● Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. SL.11-12.5 (HS-LS1-5)	● Reason abstractly and quantitatively. MP.2 (HS-LS2-4) ● Model with mathematics. MP.4 (HS-LS2-4) ● Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN-Q.A.1 (HS-LS2-4) ● Define appropriate quantities for the purpose of descriptive modeling. HSN-Q.A.2 (HS-LS2-4) ● HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-4)

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.B.1,

Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication	Curriculum compacting Challenge assignments Enrich ment activities Tiered activities Independent research/inquiry

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Highlight key vocabulary Annotation guides Think-pair- share Visual aides Modeling Cognates	Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Modified assignments Counseling	Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Unit 7: Fish

Grade: 11-12

Content Area: Life Science

Pacing: 7 instructional days

Essential Question

- What are the basic characteristics of fish?
- What were the important developments in the evolution of fish?
- How are fish adapted to life in the water?
- What are the major evolutionary differences between the three Classes of Fish?

Student Learning Objectives (Performance Expectations NJSLS-S)

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Unit Summary

Fish represent the earliest evolution of a vertebrate animal. Appearing in the fossil record over 400 million years ago, these animals have evolved and diversified to become the most diverse vertebrate grouping in the entire Kingdom. Newly developed characteristics allowed them to compete in an evolution arms race to survive the primordial oceans. These animals would eventually lead the way in moving to land and further evolving into different groups of animals.

Technical Terms

Notochord, Cartilage, Lateral Line, Swim Bladder, Oviparous, Viviparous

Disciplinary Core Ideas:	**Crosscutting Concepts:**	**Science and Engineering Practices:**
▪ 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. (NJSLS-S-HS-LS4-1) ▪ 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,	▪ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (NJSLS-S-HS-LS4-1) --- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an**	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ▪ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (NJSLS-S-HS-LS4-1) --- ***Connections to Nature of Science***

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

trait variation—that leads to differences in performance among individuals. (NJSLS-S-HS-LS4-2) **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. (NJSLS-S-HS-LS4-2) ▪ 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. (NJSLS-S-HS-LS4-4) ▪ 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. (NJSLS-S-HS-LS4-5) ▪ 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. (NJSLS-S-HS-LS4-5)	**Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-1) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-2) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-4) --- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-4) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-5)	**Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ▪ A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (NJSLS-S-HS-LS4-1) ▪ Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (NJSLS-S-HS-LS4-2) Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-4) Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in science. ▪ Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (NJSLS-S-HS-LS4-5)
Formative Assessment Measures		

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Part A: How are fish adapted to life completely in the water?
Students who understand the concepts are able to: ● Construct and revise an explanation for the adaptations and evolutionary advantages to water based life, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Part B: What are the different features of the Classes in the fish groupings?
Students who understand the concepts are able to: ● Construct and revise an explanation for the adaptations and evolutionary advantages to each fish order, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Part C: How can the fish show a transition link to amphibians?
Students who understand the concepts are able to: ● Construct and revise an explanation for the gradual transition from the fish form to that of amphibians, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Interdisciplinary Connections	
NJSLS- ELA	NJSLS- Mathematics
● Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. RST.11-12.1 (HS-LS2-3) ● Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. SL.11-12.5 (HS-LS1-5)	● Reason abstractly and quantitatively. MP.2 (HS-LS2-4) ● Model with mathematics. MP.4 (HS-LS2-4) ● Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN-Q.A.1 (HS-LS2-4) ● Define appropriate quantities for the purpose of descriptive modeling. HSN-Q.A.2 (HS-LS2-4) ● HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-4)

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.B.1,

Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Annotation guides Think-pair- share Visual aides Modeling Cognates	Extended time Answer masking Answer eliminator Highlighter Color contrast	Counseling	Critical/Analytical thinking tasks Self-directed activities

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Unit 8: Amphibia and Reptilia

Grade: 11-12

Content Area: Life Science

Pacing: 14 instructional days

Essential Questions

- What are the distinguishing characteristics of Amphibians?
- How are amphibians adapted to life on land and in the water?
- What are the key differences between the Amphibian Orders?
- What are the distinguishing characteristics of Reptiles?
- How are Reptiles adapted to life completely on land?
- What are the key differences between the Reptile Orders?

Student Learning Objectives (Performance Expectations NJSLS-S)

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Unit Summary

Amphibians are a Vertebrate class of animals that have the capability to live on land and in the water. Just like fish, they rely on the water to lay their eggs and raise their young, before the offspring develop into adults that can move around out of the water. They have slimy, porous skin that helps them breathe despite having poor lung tissue. Amphibians directly evolved from fish, and into reptiles.

Reptiles are a Vertebrate class of animals that abandoned the reliance of water and moved into living completely on land. Body adaptations such as scaling on the skin and the laying of terrestrial eggs allowed this to take place. Certain lines of reptiles evolved into the dinosaurs, while others lived alongside them while they ruled the planet during the Mesozoic Era.

Technical Terms

Devonian Period, Pelvic Girdle, Sternum, Carboniferous Period, Esophagus, Gallbladder, Pancreas, Cloaca, Double Loop Circulatory System, Urine, External Fertilization, Nictitating Membrane, Tympanic Membrane, Warning Coloration, Scale, Permian Period, Triassic Period, Internal Fertilization, Amniotic Egg, Ectothermic, Ammonia, Jacobson's Organ, Pit Organ, Ovoviviparous, Carapace, Plastron

Disciplinary Core Ideas:	**Crosscutting Concepts:**	**Science and Engineering Practices:**
▪ Sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces	▪ Different patterns may be observed at each of the scales at	

SUBJECT: Zoology **Cliffside Park Public Schools** **GRADE: 11-12**

BOE APPROVAL: August 2020

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. (NJSLS-S-HS-LS4-1) ▪ 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. (NJSLS-S-HS-LS4-2) **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. (NJSLS-S-HS-LS4-2) ▪ 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. (NJSLS-S-HS-LS4-4) ▪ 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. (NJSLS-S-HS-LS4-5) ▪ Species become extinct because they can no longer survive and reproduce in their altered environment. If	which a system is studied and can provide evidence for causality in explanations of phenomena. (NJSLS-S-HS-LS4-1) --- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-1) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-2) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-4) --- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-4)	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ▪ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (NJSLS-S-HS-LS4-1) --- ***Connections to Nature of Science*** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ▪ A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (NJSLS-S-HS-LS4-1) ▪ Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. 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SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (NJSLS-S-HS-LS4-5)	▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-5)	▪ Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (NJSLS-S-HS-LS4-5)

Formative Assessment Measures

Part A: How are amphibians adapted to life in both the water and land?

Students who understand the concepts are able to:

- Construct and revise an explanation for the combination of survival characteristics for both land and water,, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
-

Part B: How do the reptiles show a transition to both mammals and dinosaurs?

Students who understand the concepts are able to:

- Construct and revise an explanation for the gradual transition from the reptile form to the dinosaur form, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Part C: How do the amphibians show a transition to the reptiles?

Students who understand the concepts are able to:

- Construct and revise an explanation for the gradual transition from the amphibian form to the reptile form,, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
• Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. RST.11-12.1 (HS-LS2-3) • Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. SL.11-12.5 (HS-LS1-5)	• Reason abstractly and quantitatively. MP.2 (HS-LS2-4) • Model with mathematics. MP.4 (HS-LS2-4) • Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN-Q.A.1 (HS-LS2-4) • Define appropriate quantities for the purpose of descriptive modeling. HSN-Q.A.2 (HS-LS2-4) • HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-4)

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.B.1,

Modifications

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks
Think-pair- share	Answer masking		Self-directed activities
Visual aides	Answer eliminator		
Modeling	Highlighter		
Cognates	Color contrast		

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Unit 9: Dinosauria and Aves

Grade: 11-12

Content Area: Life Science

Pacing: 14 instructional days

Essential Question

- What are the basic characteristics of dinosaurs?
- What are the anatomical and adaptive differences between the Orders of Dinosaurs?
- How did dinosaurs go extinct?
- What are the basic characteristics of birds?
- How are birds adapted for flight?
- Why was the amniotic egg important to the success of both birds and dinosaurs?

Student Learning Objectives (Performance Expectations NJSLS-S)

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Unit Summary

Dinosaurs are an extinct Order of vertebrates that are closely connected in the fossil record to both birds and reptiles. These animals held reign over the planet for approximately 180 million years, evolving into many different forms, with widely different characteristics. Some of the dinosaurs discovered represent the largest animals ever to walk on the planet, providing information as to the conditions of the planet that far back. Though extinct, some of the small Theropod dinosaur lines would evolve into the modern day birds, taking some dinosaur characteristics with them.

Birds are a group of vertebrate animals that are very diverse and typically quite colorful. Birds are adapted to be the only Vertebrate (with the exception of bats) capable of sustained flight using muscles and small, evolved scales to keep in the air. They have been quite successful and can be found around the world, utilizing different adaptations to survive in a range of ecosystems and biomes.

Technical Terms

Paleontology, Paleontologist, Triassic Period, Jurassic Period, Cretaceous Period, Fossil, Imprint, Track-Way, Ornithischian, Saurischian, Meteorite, Sauropod, Theropod, Crest, Mass Extinction, Amber, Feather, Beak, Wing, Contour Feather, Down Feather, Barbule, Endotherm, Gizzard, Air Sac, Nest, Incubation, Migration, Flock

Disciplinary Core Ideas:	**Crosscutting Concepts:**	**Science and Engineering Practices:**
▪ 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	▪ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (NJSLS-S-HS-LS4-1)	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ▪ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (NJSLS-S-HS-LS4-1)

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

anatomical and embryological evidence. (NJSLS-S-HS-LS4-1) ▪ 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. (NJSLS-S-HS-LS4-2) **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. (NJSLS-S-HS-LS4-2) ▪ 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. (NJSLS-S-HS-LS4-4) ▪ 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. (NJSLS-S-HS-LS4-5) ▪ 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. (NJSLS-S-HS-LS4-5)	--- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (NJSLS-S-HS-LS4-1) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-2) ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-4) --- ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. 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(NJSLS-S-HS-LS4-1) ▪ Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. 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Arguments may also come from current or historical episodes in science. ▪ Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (NJSLS-S-HS-LS4-5)

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

	specific causes and effects. (NJSLS-S-HS-LS4-5)	

Formative Assessment Measures

Part A: How were dinosaurs so successful for such a long geological time period?

Students who understand the concepts are able to:

- Construct and revise an explanation for the success of the dinosaur group for such a long period of time,, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Part B: How are birds physiologically adapted for sustained flight?

Students who understand the concepts are able to:

- Construct and revise an explanation for the anatomical and physiological ability for birds to maintain sustained flight, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Part C: How did the dinosaurs show a transition to birds?

Students who understand the concepts are able to:

Construct and revise an explanation for the gradual transition from the dinosaur form to the bird form,, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
• Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. RST.11-12.1 (HS-LS2-3) • Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. SL.11-12.5 (HS-LS1-5)	• Reason abstractly and quantitatively. MP.2 (HS-LS2-4) • Model with mathematics. MP.4 (HS-LS2-4) • Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN-Q.A.1 (HS-LS2-4) • Define appropriate quantities for the purpose of descriptive modeling. HSN-Q.A.2 (HS-LS2-4) • HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-4)

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.B.1,

Modifications

English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding Word walls Sentence/paragraph frames	Word walls Visual aides Graphic organizers	Teacher tutoring Peer tutoring Study guides	Curriculum compacting Challenge assignments Enrichment activities

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair- share Visual aides Modeling Cognates	Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Graphic organizers Extended time Parent communication Modified assignments Counseling	Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities

SUBJECT: Zoology **GRADE: 11-12**

Cliffside Park Public Schools

BOE APPROVAL: August 2020

Unit 10: Mammalia

Grade: 11-12

Content Area: Life Science

Pacing: 10 instructional days

Essential Question

- What are the characteristics of mammals?
- How have mammals evolved to fill in a variety of ecological niches and ecosystems?

Student Learning Objectives (Performance Expectations NJSLS-S)

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Unit Summary

Mammals are considered the epitome of evolution. When looking at this group, you can see that they have incorporated almost every adaptation and survival mechanic that was introduced in an earlier studied animal and evolved appropriately. The only characteristic lacking is the concept of gills, because all mammals breathe air using their lungs. Mammals have been on the planet since the time of the dinosaurs, but they needed to remain small so that they would survive, and only started to evolve and take over once the dinosaurs were extinct. The Mammal Class is wide and diverse, the individual organisms acquiring adaptations to allow them to survive in all types of ecosystems and biomes. Mammals are the only animals to have true hair follicles and are the only animals to directly nourish the young using a fat based milk product created by the mother using her mammary glands.

Technical Terms

Mammary Gland, Subcutaneous Fat, Diaphragm, Cerebral Cortex, Fur, Monotreme, Marsupial, Placenta, Canine Teeth, Incisor Teeth, Molars, Urine

Disciplinary Core Ideas:	**Crosscutting Concepts:**	**Science and Engineering Practices:**
▪ 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. (NJSLS-S-HS-LS4-1) ▪ Natural selection occurs only if there is both (1) variation in the genetic information between	▪ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (NJSLS-S-HS-LS4-1) ---------- ***Connections to Nature of Science***	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ▪ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (NJSLS-S-HS-LS4-1) ----------

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

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SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

Formative Assessment Measures
Part A: How did mammals diversify and succeed in the absence of the dinosaurs?
Students who understand the concepts are able to: ● Construct and revise an explanation for the success of the mammals, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Part B: How did mammal evolution branch and encompass all evolutionary adaptations?
Students who understand the concepts are able to: ● Construct and revise an explanation for the success of the mammals in all kinds of biomes and environments, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Part C: How did the reptiles show a form change to that of mammals?
● Construct and revise an explanation for the form change between reptiles and mammals, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

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Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning

SUBJECT: Zoology

Cliffside Park Public Schools

GRADE: 11-12

BOE APPROVAL: August 2020

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