DataWORKS Educational Research

Science Learning Objectives & Essential Tools:

For use with Next Generation Science Standards*

DataWORKS Educational Research
www.dataworks-ed.com

*Next Generation Science Standards is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.

HIGH SCHOOL

DataWORKS Educational Research

(800) 495-1550 · WWW.DATAWORKS-ED.COM

Science Learning Objectives & Essential Tools: For use with Next Generation Science Standards

DataWORKS Educational Research has analyzed Science Standards (NGSS) and recognized the challenge educators face in creating Learning Objectives from often text-dense standards.

In Science Learning Objectives & Essential Tools, DataWORKS takes the Science Standards to a highly functional, teacher-friendly level. Each grade-level booklet offers one or more READY TO TEACH learning objectives for each standard.

"With these explicit Learning Objectives, teachers can move quickly to designing well-crafted and well-delivered lessons that focus on required skills and content."

By deciphering individual skills and concepts in the Science Standards and organizing them to create READY TO TEACH learning objectives, DataWORKS Science Learning Objectives & Essential Tools helps teachers insure they teach the required skill and content for each standard.

Science Learning Objectives
& Essential Tools

Offered exclusively by
DataWORKS Educational Research

Now educators can be sure they are delivering required skills and content for the Next Generation Science Standards.

Each guide includes:

...Learning Objectives crafted from NGSS Standards.

...Academic Vocabulary for the grade.

...Checklist for evaluating student writing samples (Literacy).

...Mini-posters for in-class support.

Guides sold by grade
(K-5, Middle School, & High School)

DataWORKS Science Learning Objectives & Essential Tools is the solution:

- for assisting teachers in comprehending, internalizing, and implementing NGSS at a glance
- for optimizing lesson prep and classroom teaching time and helping educators transition from State Standards to NGSS

Side-by-Side
Color-coded Columns

Heredity: Inheritance and Variation of Traits

Standard	Learning Objective	Clarification Statement
3.LS3.1 Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. Assessment Boundary: *Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.*	**1.1** Interpret traits that plants and animals inherit from their parents. **1.2** Analyze variations of traits in groups of similar organisms.	Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.

Science Standards **may include:**

- multiple objectives
- examples and directions
- Assessment Boundaries

Learning Objectives **include:**

- a skill (verb)
- a concept (bolded noun)
- brevity for ease of teaching
- consistency across grades

Clarification Statements **include:**

- examples for teaching concepts

Rigor

To insure rigor increases at each grade level, teachers must implement grade-level vocabulary and increase text complexity. DataWORKS Science Learning Objectives & Essential Tools includes recommended academic and content vocabulary for designing standards-based lessons.

DataWORKS Educational Research

Download a **FREE SAMPLE** now at www.dataworks-ed.com

amazon.com

Table of Contents

*Next Generation Science Standards is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.

Learning Objectives

A Learning Objective is a statement that describes what students will be able to do at the end of the lesson, independently and successfully, as a result of instruction.

Importance of Learning Objectives

- Defines the purpose of the entire lesson
- Ensures that the Independent Practice matches
- Verifies that the lesson matches a standard
- Prevents lessons from becoming activities rather than content
- Focuses students' attention when taught

Crafting Learning Objectives from Next Generation Science Standards

The Science Learning Objectives crafted from the Next Generation Science Standards contain **three major parts**:

Skills – measurable verbs that match Independent Practice (*identify*, *write*, *calculate*)
Concepts – topic or big idea of the lesson, usually nouns (*decimal*, *figurative language*)
Context – restricting condition or how to do it (*using a number line*, *in a poem*)

1. Science Standards may contain multiple Objectives.

DataWORKS crafted separate Learning Objectives for each Science Standard that had more than one Objective. Each Learning Objective can be used to create a new lesson.

Standard	Learning Objective
HS.PS4.3 Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. Assessment Boundary: *Assessment does not include using quantum theory.*	**3.1** Describe the **wave model** in electromagnetic radiation. **3.2** Describe the **particle model** in electromagnetic radiation. **3.3** Compare the **wave and particle model** of electromagnetic radiation.

2. Science Standards may contain Examples.

DataWORKS omitted the examples from the Learning Objectives. Teachers should use the examples as a guide on how to write the Skill Development for the lesson.

Standard	Learning Objective	Clarification Statement
HS.PS1.1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. Assessment Boundary: *Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.*	**1.0** Predict **properties of elements** based on valence electrons.	Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.

3. Science Standards may contain Assessment Boundaries.

DataWORKS omitted the Assessment Boundaries from the Learning Objectives. Teachers should use the Assessment Boundaries to help them create the Skill Development of the lesson.

Standard	Learning Objective	Clarification Statement
HS.PS1.6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.* Assessment Boundary: *Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.*	**6.0** Describe a change in conditions that would produce increased amounts of products at equilibrium.	Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.

High School Science Learning Objectives Overview

	Domain	Standards	Learning Objectives
	Physical Science		
Clusters	Matter and Its Interactions	8	12
	Motion and Stability: Forces and Interactions	6	8
	Energy	5	6
	Waves and Their Applications in Technologies for Information Transfer	5	7
	Life Science		
Clusters	From Molecules to Organisms: Structures and Processes	7	7
	Ecosystems: Interactions, Energy, and Dynamics	8	9
	Heredity: Inheritance and Variation of Traits	3	3
	Biological Evolution: Unity and Diversity	6	6
	Earth & Space Sciences		
Clusters	Earth's Place in the Universe	6	7
	Earth's Systems	7	7
	Earth and Human Activity	6	8
	Engineering, Technology & Applications of Science		
Clusters	Engineering Design	4	4
	Total	**71**	**84**

Matter and Its Interactions

Standard	Learning Objective	Clarification Statement
HS.PS1.1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. Assessment Boundary: *Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.*	**1.0** Predict **properties of elements** based on valence electrons.	Examples of proper ties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.
HS.PS1.2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. Assessment Boundary: *Assessment is limited to chemical reactions involving main group elements and combustion reactions.*	**2.0** Explain the **outcomes of chemical reactions.**	Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.
HS.PS1.3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. Assessment Boundary: *Assessment does not include Raoult's law calculations of vapor pressure.]*	**3.0** Infer the **strength of electrical forces** between particles.	Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.
HS.PS1.4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. Assessment Boundary: *Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.*	**4.0** Describe the **energy change in a chemical reaction.**	Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.
HS.PS1.5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. Assessment Boundary: *Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.*	**5.1** Explain the effects of changing **temperature of reacting particles** on the rate at which a reaction occurs. **5.2** Explain the effects of changing **concentration of reacting particles** on the rate at which a reaction occurs.	Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.

Matter and Its Interactions (Cont.)

Standard	Learning Objective	Clarification Statement
HS.PS1.6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.* Assessment Boundary: *Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.*	**6.0** Describe a change in conditions that would produce increased amounts of products at equilibrium.	Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products
HS.PS1.7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. Assessment Boundary: *Assessment does not include complex chemical reactions.*	**7.0** Support the claim that **atoms are conserved** during a chemical reaction.	Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques
HS.PS1.8 Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. Assessment Boundary: *Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays.*	**8.1** Describe the changes in the **composition of the nucleus of an atom during fission.** **8.2** Describe the changes in the **composition of the nucleus of an atom during fusion.** **8.3** Describe the changes in the **composition of the nucleus of an atom during radioactive decay.** **8.4** Describe the changes in the **energy released during fission, fusion, and radioactive decay.**	Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea. The section entitled "Disciplinary Core Ideas" is reproduced verbatim from A Framework for K-12 Science Education: Practices, C ross-Cutting Concepts, and Core Ideas. Integrated and reprinted with permission from the National Academy of Sciences

Motion and Stability: Forces and Interactions

Standard	Learning Objective	Clarification Statement
HS.PS2.1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. Assessment Boundary: *Assessment is limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds.*	1.0 Use **Newton's Second Law** to describe the relationship among the net force on a macroscopic object, its mass, and its acceleration.	Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force.
HS.PS2.2 Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. Assessment Boundary: *Assessment is limited to systems of two macroscopic bodies moving in one dimension.*	2.0 Support the claim that the total **momentum of a system of objects is conserved** when there is no net force on the system.	Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle.
HS.PS2.3 Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.* Assessment Boundary: *Assessment is limited to qualitative evaluations and/or algebraic manipulations.*	3.0 Design a device that minimizes the **force on a macroscopic object** during a collision.	Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a football helmet or a parachute.
HS.PS2.4 Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. Assessment Boundary: *Assessment is limited to systems with two objects.*	4.1 Describe and predict the **gravitational forces** between objects. 4.2 Describe and predict the **electrostatic forces** between objects.	Emphasis is on both quantitative and conceptual descriptions of gravitational and electric fields.
HS.PS2.5 Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. Assessment Boundary: *Assessment is limited to designing and conducting investigations with provided materials and tools*	5.1 Demonstrate that an **electric current can produce a magnetic field**. 5.2 Demonstrate that a changing **magnetic field can produce an electric current.**	Not provided.
HS.PS2.6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.* Assessment Boundary: *Assessment is limited to provided molecular structures of specific designed materials.*	6.0 Explain why the **molecular-level structure** is important in the functioning of designed materials.	Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.

Energy

Standard	Learning Objective	Clarification Statement
HS.PS3.1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. Assessment Boundary: *Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.*	**1.0** Calculate the **change in energy** of one component in a system.	Emphasis is on explaining the meaning of mathematical expressions used in the model.
HS.PS3.2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects). Assessment Boundary: *Not provided.*	**2.0** Describe **energy at the macroscopic scale.**	Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.
HS.PS3.3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.* Assessment Boundary: *Assessment for quantitative evaluations is limited to total output for a given input. Assessment is limited to devices constructed with materials provided to students.*	**3.0** Design a device that **converts one form of energy to another.**	Emphasis is on both qualitative and quantitative evaluations of devices. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency.
HS.PS3.4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). Assessment Boundary: *Assessment is limited to investigations based on materials and tools provided to students.*	**4.0** Analyze the **second law of thermodynamics.**	Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.
HS.PS3.5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. Assessment Boundary: *Assessment is limited to systems containing two objects.*	**5.1** Describe **the interactions of objects through electric fields.** **5.2** Describe the **interactions of objects through magnetic fields.**	Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other.

Waves and Their Applications in Technologies for Information Transfer

Standard	Learning Objective	Clarification Statement
HS.PS4.1 Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. Assessment Boundary: *Assessment is limited to algebraic relationships and describing those relationships qualitatively.*	**1.0** Analyze the **characteristics of waves** in various media.	Examples of data could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the Earth.
HS.PS4.2 Evaluate questions about the advantages of using a digital transmission and storage of information. Assessment Boundary: *Not provided.*	**2.0** Explain the advantages of using a **digital transmission and storage** of information.	Examples of advantages could include that digital information is stable because it can be stored reliably in computer memory, transferred easily, and copied and shared rapidly. Disadvantages could include issues of easy deletion, security, and theft.
HS.PS4.3 Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. Assessment Boundary: *Assessment does not include using quantum theory.*	**3.1** Describe **the wave model** in electromagnetic radiation. **3.2** Describe **the particle model** in electromagnetic radiation. **3.3** Compare **the wave and particle model** of electromagnetic radiation.	Emphasis is on how the experimental evidence supports the claim and how a theory is generally modified in light of new evidence. Examples of a phenomenon could include resonance, interference, diffraction, and photoelectric effect.
HS.PS4.4 Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when a*b*sorbed by matter. Assessment Boundary: *Assessment is limited to qualitative descriptions.*	**4.0** Analyze the effects that different frequencies of **electromagnetic radiation** have when absorbed by matter.	Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.
HS.PS4.5 Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.* Assessment Boundary: *Assessments are limited to qualitative information. Assessments do not include band theory.*	**5.0** Explain how technological devices use **principles of wave behavior** and interactions.	Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology

From Molecules to Organisms: Structures and Processes

Standard	Learning Objective	Clarification Statement
HS.LS1.1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. Assessment Boundary: *Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.*	1.0 Explain how the **structure of DNA** determines the structure of proteins.	Not provided.
HS.LS1.2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. Assessment Boundary: *Assessment does not include interactions and functions at the molecular or chemical reaction level.*	2.0 Describe the **hierarchy of systems within multicellular organisms.**	Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.
HS.LS1.3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. Assessment Boundary: *Assessment does not include the cellular processes involved in the feedback mechanism.*	3.0 Explain how **feedback mechanisms** maintain homeostasis.	Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.
HS.LS1.4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. Assessment Boundary: *Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis*	4.0 Describe **mitosis and differentiation** in complex organisms.	Not provided.

Standard	Learning Objective	Clarification Statement
HS.LS1.5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. Assessment Boundary: *Assessment does not include specific biochemical steps.*	**5.0** Describe how **photosynthesis** transforms light into stored chemical energy.	Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.
HS.LS1.6 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. Assessment Boundary: *Assessment does not include the details of the specific chemical reactions or identification of macromolecules.*	**6.0** Explain how **amino acids and other carbon-based molecules** are formed.	Emphasis is on using evidence from models and simulations to support explanations.
HS.LS1.7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. Assessment Boundary: *Assessment should not include identification of the steps or specific processes involved in cellular respiration.*	**7.0** Describe **cellular respiration**.	Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration

Ecosystems: Interactions, Energy, and Dynamics

Standard	Learning Objective	Clarification Statement
HS.LS2.1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. Assessment Boundary: *Assessment does not include deriving mathematical equations to make comparisons.*	**1.0** Explain factors that affect **carrying capacity of ecosystems.**	Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.
HS.LS2.2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. Assessment Boundary: *Assessment is limited to provided data.*	**2.0** Explain factors affecting **biodiversity and populations** in ecosystems.	Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.
HS.LS2.3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. Assessment Boundary: *Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.*	**3.1** Explain the **cycling of matter** in aerobic and anaerobic conditions. **3.2** Explain the **flow of energy** in aerobic and anaerobic conditions.	Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.
HS.LS2.4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. Assessment Boundary: *Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.*	**4.0** Support claims for the **cycling of matter and flow of energy among organisms.**	Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.
HS.LS2.5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. Assessment Boundary: *Assessment does not include the specific chemical steps of photosynthesis and respiration.*	**5.0** Describe the role of photo**synthesis and cellular respiration in the cycling of carbon.**	Examples of models could include simulations and mathematical models.
HS.LS2.6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. Assessment Boundary: *Not provided.*	**6.0** Analyze complex interactions in **ecosystems**.	Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.

Ecosystems: Interactions, Energy, and Dynamics (Cont.)

Standard	Learning Objective	Clarification Statement
HS.LS2.7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* Assessment Boundary: *Not provided.*	**7.0** Analyze the **impact of human activities on the environment** and biodiversity.	Examples of human activities can include urbanization, building dams, and dissemination of invasive species.
HS.LS2.8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. Assessment Boundary: *Not provided.*	**8.0** Analyze the **effect of group behavior on an organism's chance for survival.**	Emphasis is on : (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.

Heredity: Inheritance and Variation of Traits

Standard	Learning Objective	Clarification Statement
HS.LS3.1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. Assessment Boundary: *Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*	**1.0** Describe the **role of DNA and chromosomes** passed from parents to offspring.	Not provided.
HS.LS3.2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. Assessment Boundary: *Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*	**2.0** Analyze **inheritable genetic variations.**	Emphasis is on using data to support arguments for the way variation occurs.
HS.LS3.3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. Assessment Boundary: *Assessment does not include Hardy-Weinberg calculations.*	**3.0** Explain the variation and distribution of **expressed traits in a population.**	Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.

Biological Evolution: Unity and Diversity

Standard	Learning Objective	Clarification Statement
HS.LS4.1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. Assessment Boundary: *Not provided.*	**1.0** Explain the empirical evidence that supports common ancestry and **biological evolution**.	Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.
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. Assessment Boundary: *Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.*	**2.0** Explain the four factors that result in the **process of evolution**.	Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.
HS.LS4.3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. Assessment Boundary: *Assessment is limited to basic statistical and graphical analysis. Assessment does no t include allele frequency calculations.*	**3.0** Explain that organisms with an **advantageous heritable trait** tend to increase in proportion to organisms lacking this trait.	Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.
HS.LS4.4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. Assessment Boundary: *Not provided.*	**4.0** Explain how **natural selection** leads to adaptation of populations.	Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading 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. Assessment Boundary: *Not provided.*	**5.0** Explain the results of changes in **environmental conditions**.	Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.
HS.LS4.6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. Assessment Boundary: *Not provided.*	**6.0** Test a **solution to mitigate adverse impacts** of human activity on biodiversity.	Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.

Earth's Place in the Universe

Standard	Learning Objective	Clarification Statement
HS.ESS1.1 Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation. Assessment Boundary: *Assessment does not include details of the atomic and sub-atomic processes involved with the sun's nuclear fusion.]*	1.1 Illustrate the **life span of the sun**. 1.2 Explain the **role of nuclear fusion in the sun's core** on the release of energy that reaches Earth.	Emphasis is on the energy transfer mechanisms that allow energy from nuclear fusion in the sun's core to reach Earth. Examples of evidence for the model include observations of the masses and lifetimes of other stars, as well as the ways that the sun's radiation varies due to sudden solar flares ("space weather"), the 11-year sunspot cycle, and non-cyclic variations over centuries.
HS.ESS1.2 Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. Assessment Boundary: *Not provided.*	2.0 Explain the **Big Bang theory**.	Emphasis is on the astronomical evidence of the red shift of light from galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the universe, primarily found in stars and interstellar gases (from the spectra of electromagnetic radiation from stars), which matches that predicted by the Big Bang theory (3/4 hydrogen and 1/4 helium).
HS.ESS1.3 Communicate scientific ideas about the way stars, over their life cycle, produce elements. Assessment Boundary: *Details of the many different nucleosynthesis pathways for stars of differing masses are not assessed.*	3.0 Explain how **stars produce elements.**	Emphasis is on the way nucleosynthesis, and therefore the different elements created, varies as a function of the mass of a star and the stage of its lifetime.
HS.ESS1.4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. Assessment Boundary: *Mathematical representations for the gravitational attraction of bodies and Kepler's Laws of orbital motions should not deal with more than two bodies, nor involve calculus.*	4.0 Predict the **motion of orbiting object**s in the solar system.	Emphasis is on Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons.

Earth's Place in the Universe (Cont.)

Standard	Learning Objective	Clarification Statement
HS.ESS1.5 Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. Assessment Boundary: *Not provided.*	**5.0** Explain the ages of **crustal rocks using the theory of plate tectonics.**	Emphasis is on the ability of plate tectonics to explain the ages of crustal rocks. Examples include evidence of the ages oceanic crust increasing with distance from mid-ocean ridges (a result of plate spreading) and the ages of North American continental crust increasing with distance away from a central ancient core (a result of past plate interactions)
HS.ESS1.6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. Assessment Boundary: *Not provided.*	**6.0** Construct an account of **Earth's formation and early history.**	Emphasis is on using available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth's oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.

Earth's Systems

Standard	Learning Objective	Clarification Statement
HS.ESS2.1 Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. Assessment Boundary: *Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface.*	**1.0** Illustrate how Earth's internal surface processes form **continental and ocean-floor features.**	Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).

Earth's Systems (Cont.)

Standard	Learning Objective	Clarification Statement
HS.ESS2.2 Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. Assessment Boundary: *Not provided.*	**2.0** Analyze the effect of a **change to the Earth's surface** on other Earth systems.	Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.
HS.ESS2.3 Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. Assessment Boundary: *Not provided.*	**3.0** Describe the **cycling of matter by thermal convection.**	Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth's layers from high-pressure laboratory experiments.
HS.ESS2.4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. Assessment Boundary: *Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.*	**4.0** Describe how variations in the flow of energy in and out of Earth's systems result in **climate changes**.	Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.

Earth's Systems (Cont.)

Standard	Learning Objective	Clarification Statement
HS.ESS2.5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. Assessment Boundary: *Not provided.*	**5.0** Investigate the effect of the **properties of water** on Earth.	Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).
HS.ESS2.6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. Assessment Boundary: *Not provided.*	**6.0** Describe the **cycling of carbon among Earth's geospheres**.	Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.
HS.ESS2.7 Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth. Assessment Boundary: *Assessment does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems.*	**7.0** Describe the simultaneous **coevolution of Earth's systems and life on Earth.**	Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples of include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms.

Earth and Human Activity

Standard	Learning Objective	Clarification Statement
HS.ESS3.1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. Assessment Boundary: *Not provided.*	**1.1** Explain how the availability of **natural resources** have influenced human activity. **1.2** Explain how the occurrence of **natural hazards** have influenced human activity. **1.3** Explain how **changes in the climate** have influenced human activity.	Examples of key natural resources include access to fresh water (such as rivers, lakes, and ground water), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.
HS.ESS3.2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. Assessment Boundary: *Not provided.*	**2.0** Analyze solutions for **developing, managing, and utilizing energy** and **mineral resources**.	Emphasis is on the conservation , recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is no t. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.
HS.ESS3.3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. Assessment Boundary: *Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.*	**3.0** Illustrate the relationships among **management of natural resources, the sustainability of human populations, and biodiversity.**	Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning

Earth and Human Activity (Cont.)

Standard	Learning Objective	Clarification Statement
HS.ESS3.4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. Assessment Boundary: *Not provided.*	**4.0** Analyze solutions that **reduce the impact of human activities on natural systems.**	Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local effort s (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).
HS.ESS3.5 Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. Assessment Boundary: *Assessment is limited to one example of a climate change and its associated impacts.*	**5.0** Analyze **global climate models** to forecast the current rate of climate change and associated impacts on Earth.	Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).
HS.ESS3.6 Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. Assessment Boundary: *Assessment does not include running computational representations but is limited to using the published results of scientific computational models.*	**6.0** Illustrate the relationships among **Earth systems and how they are being modified by human activity**.	Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.

High School – Engineering, Technology & Applications of Science

Engineering Design

Standard	Learning Objective	Clarification Statement
HS.ETS1.1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. Assessment Boundary: *Not provided.*	**1.0** Analyze a major global challenge.	Not provided.
HS.ETS1.2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. Assessment Boundary: *Not provided.*	**2.0** Design a solution to a complex real-world problem.	Not provided.
HS.ETS1.3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. Assessment Boundary: *Not provided.*	**3.0** Evaluate a solution to a complex real-world problem.	Not provided.
HS.ETS1.4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. Assessment Boundary: *Not provided.*	**4.0** Use a computer simulation to model the impact of solutions to a complex real-world problem.	Not provided.

Types of Vocabulary

(Across Grades)

DataWORKS		Academic Vocabulary	Content Vocabulary	Support Vocabulary
		- used across **all disciplines** (*Often not taught in Textbooks*) Examples: *distinguish, corresponds, combine, separate, analysis, symbolic*	- content **specific** (*Taught during Concept Development in EDI Lessons*) Examples: *main idea, thesis statement, figurative language.* *denominator, linear equation, addition, ratios, perimeter* *Civil War, separation of powers, legislative branch.* *mitosis, cell wall, photosynthesis, Solar System*	- in **specific textbooks and worksheets**; may be challenging for EL students (*Often over-emphasized in Textbooks*) Examples: *halibut, hammock, port, starboard*

Reading Success

Readers can read effectively when they can understand at least 95% of the words they read. Knowing only the most common 2000 words, studies show that readers should be able to comprehend about 80% of an average academic text. Adding in a list of 570 Academic and Content Vocabulary* words brings that total up to 90% comprehension (Nation & Waring, 1997). The remaining unknown words in academic text will largely be Content and Support Vocabulary and should be learned within the context of lessons throughout the school year.

Words Known	Comprehension
Most common 2000 words	80%
Plus 570 Academic Vocabulary Words	90%
Plus Remaining Content and Support Vocabulary	95-100%

* DataWORKS has taken the list of 570 words and further categorized them as Academic or Content based on their potential use. For example *area* is an academic vocabulary word when referring to area of study; however, *area* is a content vocabulary word when referring to the space of a two-dimensional figure.

To compile this vocabulary list, DataWORKS has analyzed the text of the Next Generation Science Standards and extracted the **most important Academic** and **Content** area vocabulary. These vocabulary lists:

- Should be used when designing Next Generation Science lessons.
- Are broken down into Academic and Content Vocabulary. Some words can be both.
- Feature grade-appropriate definitions.
- Note the frequency of each word within the standards (in parentheses after the word if the word is used more than once).

Example

connection (2) – link, relationship

vocabulary from the standards | frequency of word within the standards | grade-appropriate definition

In addition, the DataWORKS Word Lists (by grade level) can be found at www.dataworks-ed.com/resources.

A

adaptation – a change made for a particular purpose
affect (2) – *v.* to influence or make a difference
analyze (4) – look at carefully to identify the elements of something and how those elements are related
availability – the quality of being ready to use

B

benefit – an advantage gained from something
bulk – a large mass or shape

C

capacity – the largest amount that something can hold or support; the ability to receive or contain
challenge – a situation or task that tests or stretches one's abilities
clarify – explain or make clearer
communicate (4) – exchange or share information
complex (4) – made up of many different parts
component (3) – a part of a larger whole, particularly a part of a machine
computational – related to using computers
concentration (2) – the act of focusing attention to a task
concepts (2) – an idea or notion

C Continued

conduct (5) – *v.* do or carry out (e.g., conduct a survey or experiment)
consistent – without significant change over a period of time.
constraints (4) – limitations or restrictions
construct (10) – build
convert – change into something different
create (4) – make
criteria (3) – principles or standards by which something may be judged

D

data (3) – information about something
design (7) – *n.* a plan that shows the look, function or workings of something; *v.* to create a plan that shows the look, function, or workings of something.
device (3) – a thing made for a particular purpose, especially mechanical or electrical
differentiation – cells becoming different; the act of creating different structures in an organism
distribution (2) – the spread of a trait through a population of organisms (e.g., how many of a group has blue eyes, larger claws, thicker fur, etc.)

E

emergence – the process of coming into being
empirical – based on observation or experience rather than theory or pure logic
error – a mistake
evaluate (11) – find the value of or decide on its importance after study
evidence (25) – facts that prove or disprove something; proof

F

factors (3) – circumstances, facts, or other influences on the result of something
features – parts of something; observable parts or appearance (e.g., features of the landscape)
function (3) – the purpose something is used for

H

hierarchical – arranged in order of rank

I

illustrate (13) – show or describe
impact (6) – strongly hit something; influence how something reacts or behaves
individual (3) – separate

I Continued

infer – make a conclusion based on information
instructions – directions
interacting (2) – have an effect on another; acting reciprocally
interactions (3) – reciprocal action or influence
internal – inner parts; of the inside of something
investigation (5) – the act of studying or examining closely

M

maintain (3) – continue doing something; support a group or population
major – important or significant
mechanisms – pieces of machines; natural or established processes that operate regularly
media – forms of communication (e.g., writing, video recordings, digital files, etc.)
minimizes – reduces to the smallest amount
model (12) – a representation of a system or a thing used as an example
modified – changed

O

occur (4) – happen
outcome – result

P

potential – having the ability to do something in the future

predict (3) – *v.* estimate what will happen in the future or what will result from a set of actions

primarily – mainly; for the most part

principles (3) – laws or basic truths

prioritize – treat something as more important than other things; mark something as more important and urgent

process (4) – a systematic or definite series of changes, often in an organism or system

proportion – a number considered while compared to the whole (e.g., the number of blue markers per box)

publish – print or share text or results; make something public

Q

qualitative – related to the quality of something instead of its number

quantitative (2) – related to the number of something

R

range – variety; the distance between two places, objects, or ideas

ratios – a relationship between two amounts that shows the number of times one value is contained within the other

R Continued

reacting – interaction between particles that causes a chemical or physical change

refine (5) – improve by changing something that makes a small difference; make something more pure

relevant – important

reliability (2) – dependability

resources (4) – the supply of available assets (e.g., oil, food, water, etc.)

revise (5) – rewrite to improve

role (4) – job

S

selection – a choice

simulation – something that imitates the behavior of a situation or process, usually for the purpose of study

specific – a certain kind

specify (2) – identify clearly

stable – not likely to change

statistics (2) – the practice of collecting and analyzing numerical data in large amounts to look for patterns and proportions

structure (3) – how something is put together

survive (2) – continue to live or exist, particularly when threatened by danger

S Continued

sustainability – done at a rate able to be maintained; ability to maintain steady level through reuse of resources

T

technical (2) – of or related to a particular field of activity, usually industrial, practical, or mechanical
technological (2) – relating to or using technology
theory (2) – a system of ideas that is supposed to explain something, particularly an explanation based on principles separate from the thing to be described
transfer (2) – move from one place to another
transform – make thorough changes in form, appearance, or character
transmission – the action of sending information, often through digital means
transmit – sending information
trend – a general way in which something is developing

U

uniform – the same across all things
utilizing – making good use of something

V

validity – being based on truth or fact; soundness
variation (4) – differences among a group, specifically differences in traits

W

whereby – by which

A

absorb – take in; soak up
acceleration – increasing rate or speed
atom (4) – the smallest unit of a chemical element

B

bond – something that fastens things together

C

capture – absorb or bring into
chemical properties – properties of materials related to reactions that can change them
chemical reaction (3) – a process that involves rearranging the molecules of a substance
closed system – a system where no additional energy comes in
collision – when an object strikes another, often violently
computational – made using a computer or mathematical system
conserved – not changed; maintained or protected

D

digital – computer based

E

electric current – the flow of electricity through conductive material
electric field – the region around an electrically charged body, within which a force is exerted
electrical forces – the interaction between an electrically charged body and other objects
electromagnetic radiation (2) – a kind of radiation including visible light, radio, gamma rays, and X-rays
electron (2) – a stable subatomic particle with a negative charge
electrostatic forces – the forces that electrically charged particles have on one another
elements – the basic units of matter that cannot be broken down into simpler substances (e.g., iron, oxygen, nitrogen, argon, etc.)
energy (9) – property of matter and radiation that has the capacity to perform work
energy level – the fixed amount of energy that something can have, specifically electrons within atoms
equilibrium – balance between opposing forces

F

fission – a reaction where the nucleus of an atom splits with a release of energy

force – strength or energy as an attribute of physical action or movement

frequency – the rate at which something occurs or is repeated over a particular period of time, often related to the speed of a wave

fusion – a reaction where atomic nuclei of a low atomic number fuse to form a heavier nucleus with the release of energy

G

gravitational forces – the interaction of masses through the force of gravity

M

macroscopic (3) – large enough to be seen by the naked eye; on a large scale

magnetic field (2) – region around a magnetic material or moving electric charge within which the force of magnetism acts

mathematical (5) – based upon math

molecular – related to molecules

momentum – the quantity of motion of a moving body, measured as a product of its mass and velocity

N Continued

nucleus – the center of an atom that holds protons and neutrons

O

outermost (2) – farthest from the center

P

particles (3) – a small piece of matter

periodic table (2) – a table of the elements arranged in order by their atomic number

R

radioactive decay – the process where an unstable atom loses energy by emitting particles of ionizing radiation

reaction – a process where two or more substances act on each other and are changed into different substances or one substance changes into two or more other substances

release (2) – the action of allowing something to move or escape (e.g., a release of energy from the fuel rods heats the surrounding water in a reactor)

S

storage – keeping something, particularly data, for future use

T

thermal – related to temperature

thermal energy – heat

thermodynamics – the branch of science that deals with the transfer of energy, particularly heat

W

wavelength – the distance between two adjacent crests in a wave

wave (2) – a regular disturbance that moves through a material without significantly changing where all the particles are in it; a variation of an electromagnetic field in the movement of light or other radiation

A

advantageous – creating a favorable situation that increases the chances of survival
adverse – unfavorable or harmful
aerobic – involving or requiring oxygen
amino acids – simple organic compounds
anaerobic – involving or requiring an absence of oxygen
ancestry – the origins or background of something
atmosphere – envelope of gases surrounding a planet

B

biodiversity (3) – the variety of life in a particular area
biological – of or relating to living organisms
biosphere – the regions of a planet, particularly the Earth, that are occupied by living organisms
bond – something that fastens things together

C

carbon-based molecules – molecules with one or more carbon bonds; organic molecules
cells – smallest complete structure or unit of an organism
cellular – related to cells
cellular respiration (2) – the process where organisms get energy from organic molecules
chemical energy – energy that can be released by a reaction between chemicals

C Continued

chemical process – a process determined by the atomic and molecular composition and the structure of the substances involved
chromosomes – small structures that carry the genetic information
coding – specifying the genetic sequence for something
compound – a thing that is made up of two or more separate elements
computational – made using a computer or mathematical system

D

DNA (2) – the structure that contains genetic material; stands for deoxyribonucleic acid

E

ecosystem (4) – a community of interacting biological organisms and their habitat
elements – the basic units of matter that cannot be broken down into simpler substances (e.g., iron, oxygen, nitrogen, argon, etc.)
energy (4) – property of matter and radiation that has the capacity to perform work
environment (2) – the surroundings or conditions that a living organism lives in

E Continued

environmental (2) – relating to the natural world and the impact of human activity on it

evolution (2) – the process by which different living organisms developed and diversified from earlier forms via natural selection

extinction – coming to an end or dying out, as in the state of a species no longer existing

F

feedback – the modification or control of a process or system by its results or effects

G

genetic (2) – relating to genes or heredity

geosphere – any of the concentric regions of matter that make up the earth and the atmosphere

H

heritable (2) – able to be inherited or passed on through genes

homeostasis – the tendency toward a relatively stable balance between different forces, particularly as maintained by physical processes

hydrosphere – all the waters on earth's surface

I

inheritable – able to be received from parents, particularly genetic traits

L

light energy – energy transmitted by electromagnetic waves in the visible spectrum

M

mathematical (3) – based upon math

meiosis – a type of cell division that results in four daughter cells with half of the chromosomes of the parent cell, primarily used in sexual reproduction

mitigate – make less serious or painful

mitosis – a type of cell division that results in two daughter cells each having the same number and kind of chromosomes of the parent cell

molecules (2) – a group of atoms bonded together; the smallest fundamental unit of a chemical compound

multicellular – an organism composed of two or more cells

mutation (2) – a change in the structure of a gene that can be transmitted to offspring

N

net transfer – the total amount of something transferred when all movement is taken into account

O

offspring – children or other progeny

organisms (6) – an individual animal, plant, or single-celled life form

P

photosynthesis (2) – the process that plants use to create food from carbon dioxide, water, and the energy from sunlight

proliferation – a rapid increase

proteins – an organic compound composed of chains of amino acids that are found in all living organisms

R

replication – a cell or organism copying itself, performing mitosis or meiosis

S

sexual reproduction – reproduction where two organisms combine half of their genetic material into offspring

simulation – a representation of a system used for study or prediction

species (3) – a group of similar living organisms capable of exchanging genes or interbreeding

sugar – any of a certain kind of carbohydrates found in living tissues

T

trait (3) – a characteristic determined by genes

V

viable – capable of working successfully

A

astronomical – related to astronomy, planets, space, stars, and the like
atmosphere – envelope of gases surrounding a planet

B

biodiversity – the variety of life in a particular area
biosphere – the regions of a planet, particularly the Earth, that are occupied by living organisms

C

climate (3) – the prevailing weather conditions of an area, usually over a long period
coevolution – the evolutionary influence that species have on one other (e.g., a prey animal becoming faster, thus causing an increase in the speed of the predator)
computational (3) – made using a computer or mathematical system
continental – forming or belonging to a continent
continental crust – the thick part of the crust that forms the large land masses
convection – the movement caused within fluid by hot material rising and by cooler material sinking
crust – the surface of the earth or moon
cycle – a series of related and repeated events; the mixing or moving of matter or energy

E

elements – the basic units of matter that cannot be broken down into simpler substances (e.g., iron, oxygen, nitrogen, argon, etc.)
energy (2) – property of matter and radiation that has the capacity to perform work

F

feedback – the modification or control of a process or system by its results or effects
forecast – *n.* the prediction of a future event, especially concerning coming weather
fusion – a reaction where atomic nuclei of a low atomic number fuse to form a heavier nucleus with the release of energy

G

galaxies – systems of millions or billions of stars together with gas, dust, and other stellar objects held together through gravity
geoscience (2) – earth science, particularly geology
geosphere – any of the concentric regions of matter that make up the earth and the atmosphere
global climate – the patterns of temperature, humidity, and other weather systems for the planet

H

hazards – dangers
hydrosphere – all the waters on earth's surface

I

interior – situated inside of something

M

mathematical – based upon math
meteorites – pieces of rock and metals that survive entry into earth's atmosphere and strike the ground

N

natural resources – the available assets from the natural world (e.g., oil, coal, fresh water, etc.)

O

oceanic crust – part of the earth's crust under the ocean basins
orbiting – a celestial object's movement around a larger object

P

planetary – of or relating to planets
plate tectonics – a theory that explains the structure of earth's crust and many geologic events that result from the interplay between large plates over the surface of the earth

R

regional climate – the weather of a particular large area
release – the action of allowing something to move or escape (e.g, a release of energy from the fuel rods heats the surrounding water in a reactor)

S

simulation – a representation of a system used for study or prediction
simultaneous – happening at the same time
solar system – the system of planets centered around our sun, including all the planets and other material in orbit
spatial – related to space
spectra – the range of wavelengths of electromagnetic radiation, sometimes particularly in relation to visible light

T

temporal scales – the scale of time used (e.g., years versus centuries)

thermal – related to temperature

A

aesthetics – a set of principles that defines the nature and appreciation of beauty

C

cultural – of or relating to the ideas, customs, and social behavior of a society

E

environmental – relating to the natural world and the impact of human activity on it

M

manageable – able to be completed relatively easily

P

particles (3) – small pieces of matter

S

simulation– a representation of a system used for study or prediction

societal – of or related to society

T

trade-off – a balance achieved by sacrificing some of one desirable trait to gain more in another; a compromise

Content-Based Writing Checklist
History Grades 9-12

Expression of History Knowledge	**Argument**
<u>Meets Expectations of Assignment</u>: ☐ Content is appropriate for purpose ☐ a. States an argument/claim/opinion on historical topic ☐ b. Brings in relevant historical facts, events, and concepts ☐ c. Supports a position with textual evidence ☐ d. Uses logical organization (progression) of ideas ☐ Uses appropriate sources ☐ a. Cites primary and secondary sources ☐ b. Compares and weighs evidence ☐ c. Quotes and paraphrases sources without plagiarizing ☐ Provides a conclusion ☐ a. Summarizes and emphasizes main points of argument	**<u>Structure Guidelines</u>:** ☐ Introduces claims ☐ a. Distinguishes claim from opposing claim ☐ Organizes the reasons and evidence ☐ a. Uses structure to support the writer's purpose (letter format, essay, speech) ☐ Supports claims ☐ a. Uses logical reasoning ☐ b. Uses relevant evidence ☐ c. Uses accurate credible sources ☐ Uses appropriate transitions ☐ a. Clarifies the relationships among claims, and evidence **<u>Grade-Appropriate Conventions</u>:** ☐ Spells correctly ☐ a. Domain-specific vocabulary ☐ b. Grade-appropriate vocabulary ☐ Uses proper style ☐ a. Maintains consistent formal style and objective tone ☐ b. Expresses ideas concisely and precisely ☐ Grammar and punctuations
<u>Comments:</u>	

9-10.WHST.1
11-12.WHST.1

Content-Based Writing Checklist
History Grades 9-12

Expression of History Knowledge	**Informative/Explanatory**
<u>Meets Expectations of Assignment</u>: ☐ Content is appropriate for purpose ☐ a. Analyzes origins and significance of historical events ☐ b. Brings in relevant historical facts, events, and concepts ☐ c. Demonstrates understanding of the task ☐ Uses appropriate sources ☐ a. Cites primary and secondary sources ☐ b. Compares and weighs evidence ☐ c. Quotes and paraphrases sources without plagiarizing ☐ Provides a conclusion ☐ a. Summarizes and supports the information explained	**<u>Structure Guidelines</u>:** ☐ Introduces the topic ☐ Organization ☐ a. Organizes information using strategies such as definition, comparison/ contrast, and cause/effect ☐ b. Uses graphics and/or multimedia to aid in comprehension ☐ Develops the topic ☐ a. Collects and presents specific, relevant, and accurate evidence. ☐ b. Uses multiple sources to gather information (examples and quotations) ☐ Uses appropriate transitions ☐ a. Clarifies the relationships among ideas and concepts **<u>Grade-Appropriate Conventions</u>:** ☐ Spells correctly ☐ a. Domain-specific vocabulary ☐ b. Grade-appropriate vocabulary ☐ Uses proper style ☐ a. Maintains consistent formal style and objective tone ☐ b. Expresses ideas concisely and precisely ☐ c. Adheres to appropriate style manual *(Turabian or MLA)* ☐ Grammar and punctuation
<u>Comments</u>:	

9-10.WHST.2
11-12.WHST.2

Content-Based Writing Checklist
Science and Technical Grades 9-12

Expression of Science Knowledge

Meets Expectations of Assignment

- ☐ Content is appropriate for purpose
  - ☐ a. States an argument/claim/opinion on scientific topic
  - ☐ b. Brings in relevant scientific terms, facts, and/or principles
  - ☐ c. Discusses results and significance of scientific topic
  - ☐ d. Uses logical organization (progression) of ideas
- ☐ Uses appropriate sources
  - ☐ a. Presents data effectively (charts, tables, etc.)
  - ☐ b. Compares and weighs evidence
  - ☐ c. Quotes and paraphrases sources without plagiarizing
- ☐ Provides a conclusion
  - ☐ a. Summarizes and emphasizes main points of argument

Argument

Structure Guidelines:

- ☐ Introduces claims
  - ☐ a. Distinguishes claim from opposing claim
- ☐ Organizes the reasons and evidence
  - ☐ a. Uses structure to support the writer's purpose (letter format, presentation)
- ☐ Supports claims
  - ☐ a. Uses logical reasoning
  - ☐ b. Uses relevant evidence
  - ☐ c. Uses accurate credible sources
- ☐ Uses appropriate transitions
  - ☐ a. Clarifies the relationships among claims, and evidence

Grade-Appropriate Conventions:

- ☐ Spells correctly
  - ☐ a. Domain-specific vocabulary
  - ☐ b. Grade-appropriate vocabulary
- ☐ Uses proper style
  - ☐ a. Maintains consistent formal style and objective tone
  - ☐ b. Expresses ideas concisely and precisely
- ☐ Grammar and punctuation

Comments:

9-10.WHST.1
11-12.WHST.1

Content-Based Writing Checklist
Science and Technical Grades 9-12

Expression of Science Knowledge

Meets Expectations of Assignment:

- ☐ Content is appropriate for purpose
  - ☐ a. Examines research using scientific principles
  - ☐ b. Brings in relevant scientific facts, concepts, and principles
  - ☐ c. Demonstrates understanding of the task
- ☐ Uses appropriate sources
  - ☐ a. Provides variety of sources for support
  - ☐ b. Compares and weighs evidence
  - ☐ c. Quotes and paraphrases sources without plagiarizing
- ☐ Provides a conclusion
  - ☐ a. Summarizes and supports the information explained

Informative/Explanatory

Structure Guidelines:

- ☐ Introduces the topic
- ☐ Organization
  - ☐ a. Organizes information using type of text structure such as description, problem/solution, and cause/effect
  - ☐ b. Uses graphics and/or multimedia to aid in comprehension
- ☐ Develops the topic
  - ☐ a. Collects and presents specific, relevant, and accurate evidence.
  - ☐ b. Uses multiple sources to gather information (examples and quotations)
- ☐ Uses appropriate transitions
  - ☐ a. Clarifies the relationships among ideas and concepts

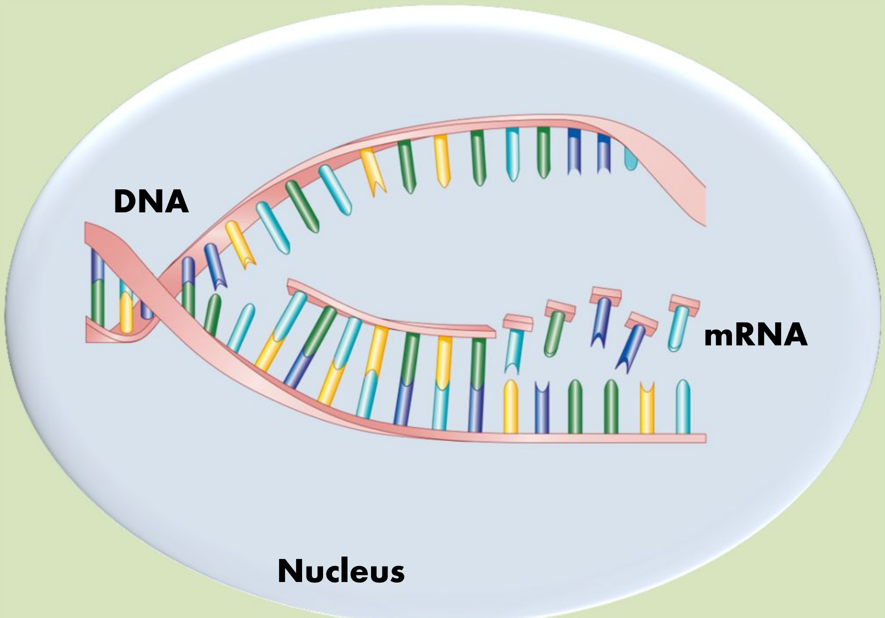
Grade-Appropriate Conventions:

- ☐ Spells correctly
  - ☐ a. Domain-specific vocabulary
  - ☐ b. Grade-appropriate vocabulary
- ☐ Uses proper style
  - ☐ a. Maintains consistent formal style and objective tone
  - ☐ b. Expresses ideas concisely and precisely
  - ☐ c. Adheres to appropriate style manual *(APA or MLA)*
- ☐ Grammar and punctuation

Comments:

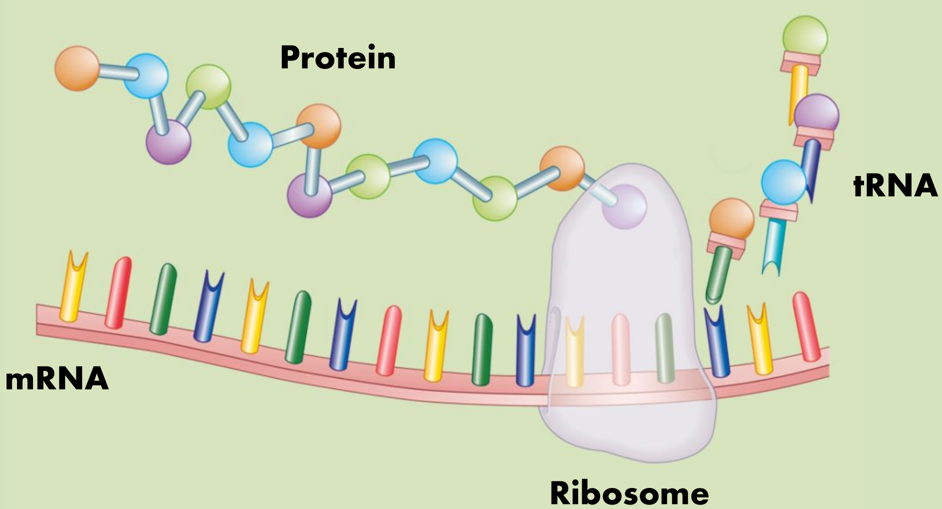
9-10.WHST.2
11-12.WHST.2

DNA and Proteins



Transcription

An mRNA template is formed using sections of DNA.

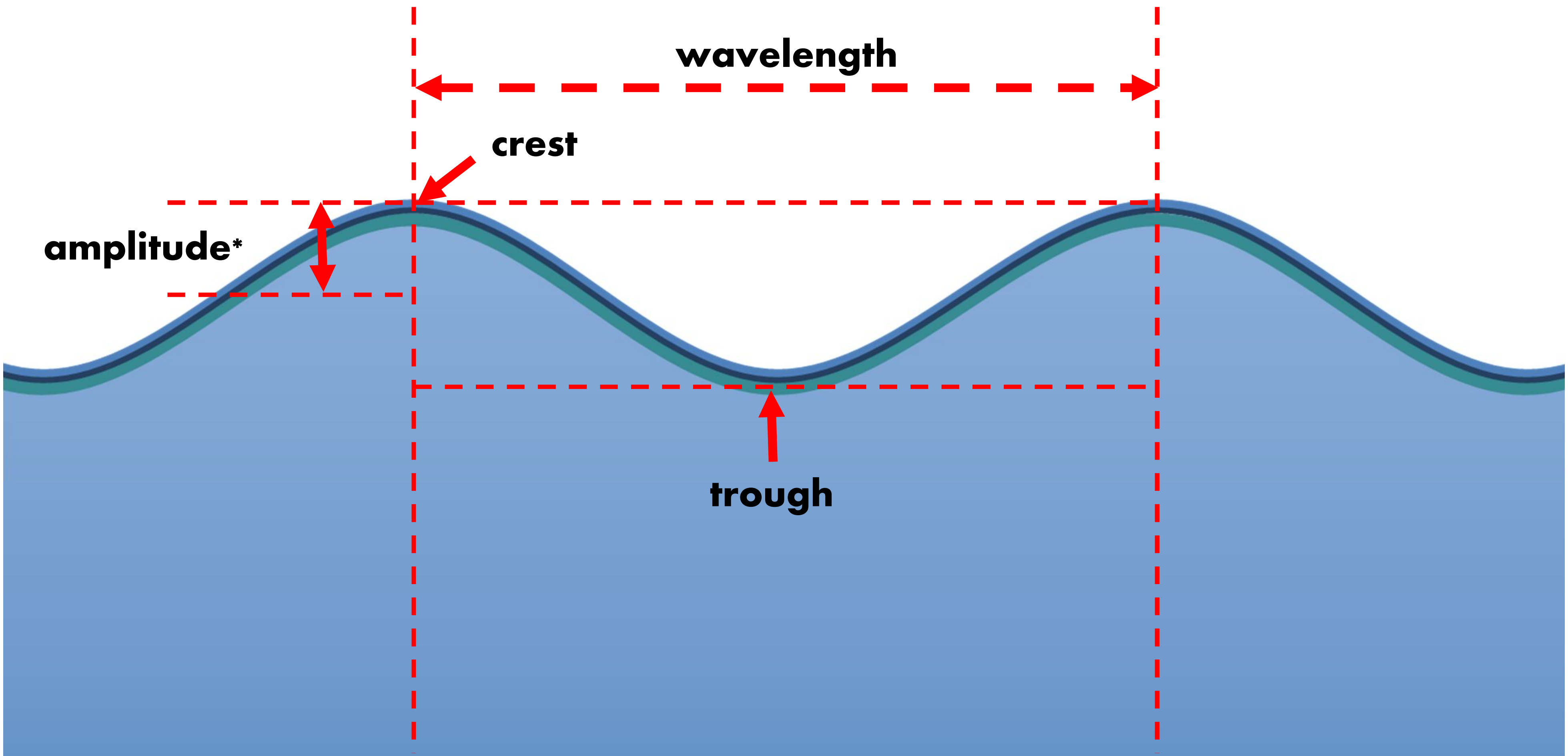


Translation

tRNA carries amino acids and they are bonded together in the ribosomes using the mRNA template.

HS.LS1.1

Attributes of Waves



* Amplitude can be measured in several different ways. The most common measure is the maximum displacement from the resting state (crest or trough to the center of the wave). Feel free to introduce students to other definitions of amplitude.

HS.PS4.1

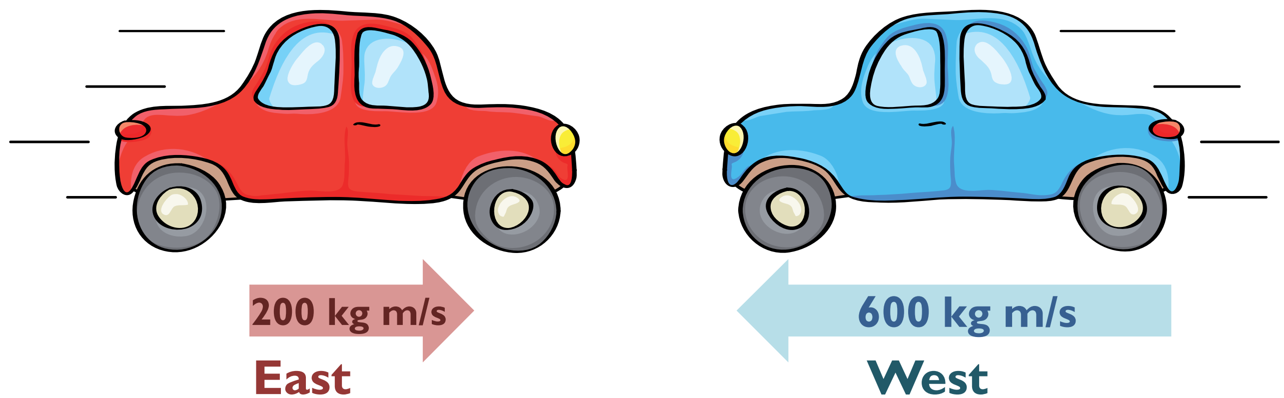
Conservation of Momentum

Total momentum of a closed system is constant

Momentum Before

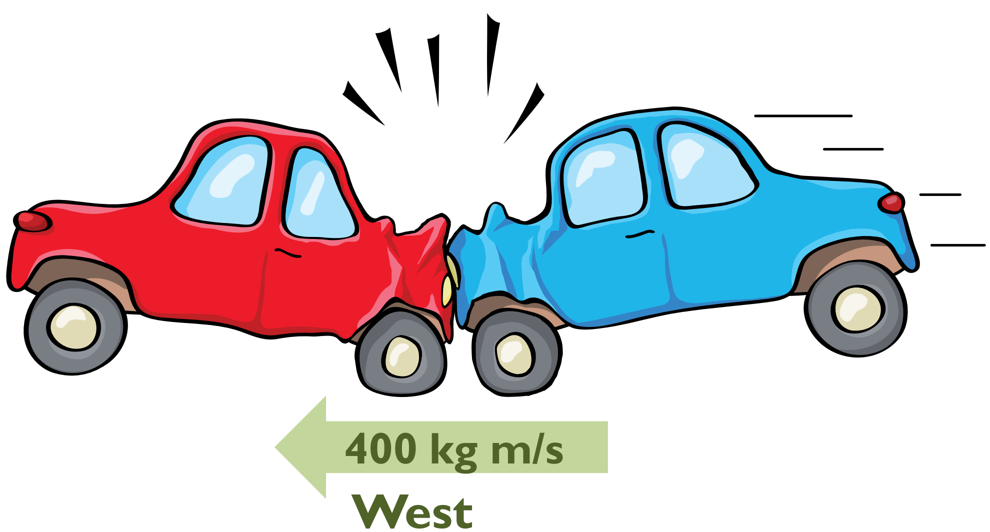
600 kg m/s West
– 200 kg m/s East

400 kg m/s West



Momentum After

400 kg m/s West

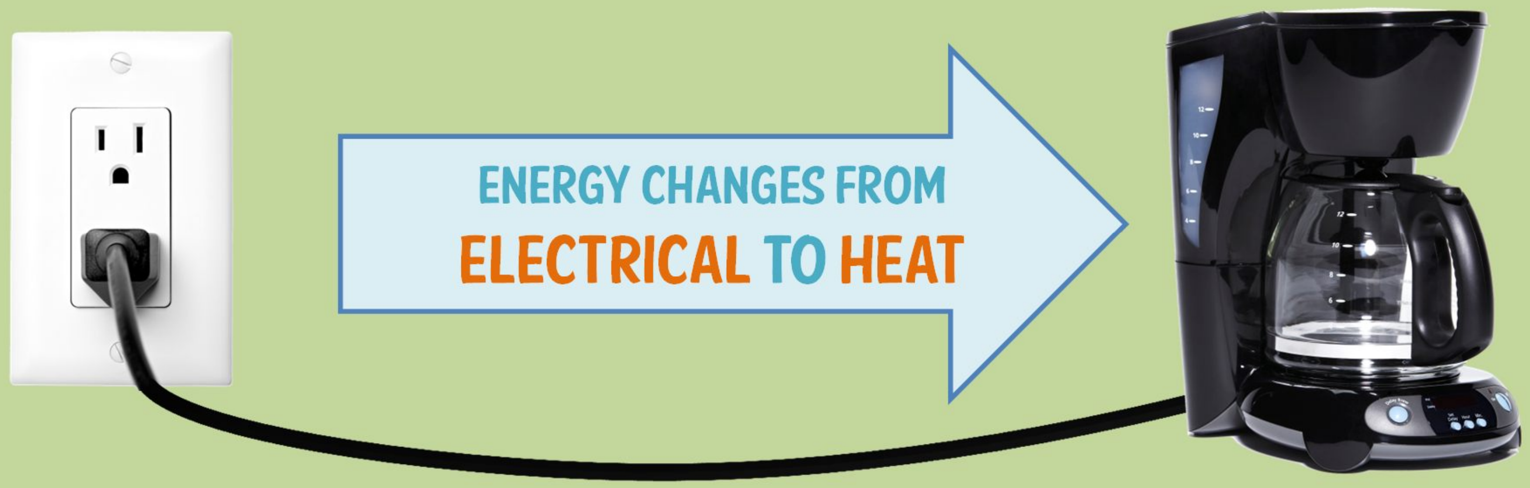


DataWORKS Educational Research
WWW.DATAWORKS-ED.COM

HS.PS2.2

Conservation and Transfer of Energy

TOTAL ENERGY REMAINS THE SAME WHEN TRANSFERRED FROM ONE SYSTEM TO ANOTHER



ELECTRICAL ENERGY

HEAT ENERGY

DataWORKS Educational Research
WWW.DATAWORKS-ED.COM

HS.PS3.1

Science READY TO TEACH™ Lessons

If you like Science Learning Objectives & Essential Tools, check out DATAWORKS Science READY TO TEACH™ Lessons.

FREE LESSON DOWNLOADS available along with fee-based personal, school-site, or district-wide licensing.

Visit DataWORKS online Store and click into the Science Lesson Catalog (www.dataworks-ed.com).

DataWORKS READY TO TEACH™ Explicit Direct Instruction® (EDI®)* Lessons have always been rigorously aligned to standards and strongly focused on NGSS requirements.

*Explicit Direct Instruction® (EDI®), is a strategic collection of research-based, instructional practices combined to help teachers design and deliver well-crafted lessons that explicitly teach grade-level content and increase language acquisition for all students.

PAGE AT-A-GLANCE:

Science Learning Objective & Science READY TO TEACH EDI Lesson Page

All interactive, multi-media lessons (K-12) feature:

- Rigorous, grade-level expository text and 2-7 new academic vocabulary words defined
- Emphasis on deep conceptual understanding with optional scaffolding for differentiation
- Opportunities to use evidentiary arguments and/or multiple representations when solving problems

Building Knowledge
Clear Conceptual Definitions

Academic Vocabulary

Text-based Answers

Writing from Sources

Higher-Order Questions

Biological Evolution: Unity and Diversity

Standard	Learning Objective	Clarification Statement
MS.LS4.4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. Assessment Boundary: *None.*	4.0 Describe how **genetic variations** increase probability of surviving and reproducing.	Emphasis is on using simple probability statements and proportional reasoning to construct explanations.

Skill Development/Guided Practice

Natural selection is a process where individuals within a species that are better adapted to survive and reproduce in their environment produce the most offspring.

Variation	*Within a population, organisms of the same species show individual variation in appearance and behavior, such as body size, hair color, facial markings, etc.*
High rate of population growth	*Within a population, many species produce more offspring each year than the environment can support, leading to a struggle for resources. Each generation experiences many deaths.*
Differential survival and reproduction	*Individuals possessing traits that help them survive will contribute more offspring to the next generation.*
Inheritance	*Some traits are consistently passed on from parent to offspring.*

Describe how Darwin's theory of natural selection is one of the mechanisms for evolution.

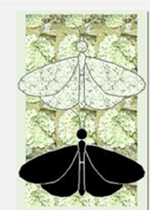
1 Read the scenario carefully.
a Identify information how the environment changed and which variation survived. (underline)
2 Describe the change in terms of natural selection.

1. **English peppered moths**- Peppered moths are a common insect living in England and other parts of Europe. The trees that peppered moths live in have light-colored bark. While the typical peppered moth is light, some have dark bodies. In the past, these darker moths were very rare. But that changed around 150 years ago when the darker moths became more common. During that time, England was experiencing what is known as the Industrial Revolution. Factories were being built, and they ran by burning coal for fuel. The result was a dark smoke that covered the countryside. Trees that used to be light were now dark.

The dark-colored moths variation survived because, when the trees became dark, the white moths were eaten more often. The black moths were not eaten as often and were able to survive to reproduce.

CFU

1a How did I/you identify the information that was needed?
2 How did I/you describe the adaptation in terms of natural selection?



DataWORKS Educational Research

NEXT GEN. Middle School Science MS-LS4-4
Describe how Darwin's theory of natural selection is one of the mechanisms for evolution.
Lesson to be used by EDI-trained teachers only

Free Downloads and Purchase Information

For free downloads or to purchase Common Core Learning Objectives & Essential Tools or Common Core READY TO TEACH® Lessons, visit www.dataworks-ed.com and click into the online store.

About DataWORKS Educational Research

DataWORKS offers a variety of Common Core professional development training along with products and services including Explicit Direct Instruction, English Learner Workshops, lesson demonstrations in live classrooms, interactive coaching, lesson design training, as well as parental involvement, after-school and summer acceleration programs (StepUP Academies). Implementation support is available for educators, administrators and parents.

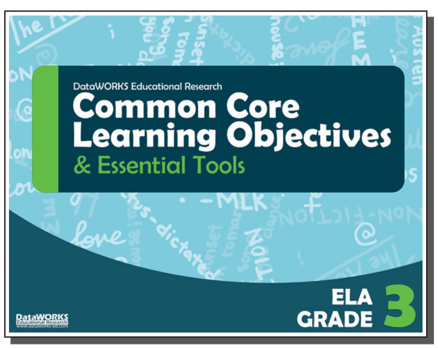
Contact DataWORKS Client Relations Department for more information:

info@dataworks-ed.com (800) 495-1550

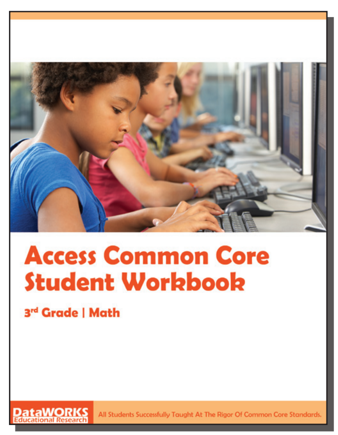
John Hollingsworth and Dr. Silvia Ybarra co-founded DataWORKS with the single purpose of using real data to improve student learning, especially for English Language Learners and other low-performing students. Now, DataWORKS focuses on GIFT–Great Initial First Teaching—so students learn more grade-level skills and content the first time a lesson is taught. Analyzing test scores does not help improve student achievement; delivering great, grade-level lessons ... every lesson, every day ... helps improve student achievement.

John and Silvia are co-authors of three educational bestsellers: *Explicit Direct Instruction for English Learners* (Corwin, 2013), *Explicit Direct Instruction: The Power of the Well-Crafted, Well-Delivered Lesson* (Corwin, 2009) and Multiple Measures: Accurate Ways to Assess Student Achievement (Corwin, 2000) co-authored along with Joan Ardovino.

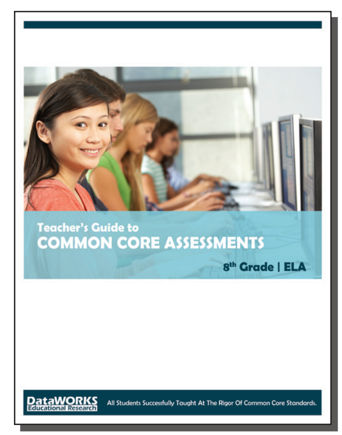
Other Teacher Resources offered by DataWORKS:



- K – 12 ELA & K - 8 Math
- Algebra, Algebra II, Geometry
- 6-12 Literacy Objectives
- K - HS Science



Math and ELA Guides for grades 3-8 and 11 (14 total guides)



Math and ELA Guides for grades 3-8 and 11 (14 total guides)

DataWORKS Educational Research
www.dataworks-ed.com

facebook.com/dataworksed

HIGH SCHOOL