DataWORKS Educational Research

Science Learning Objectives & Essential Tools:

For use with Next Generation Science Standards*

SAMPLE

DataWORKS Educational Research
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.

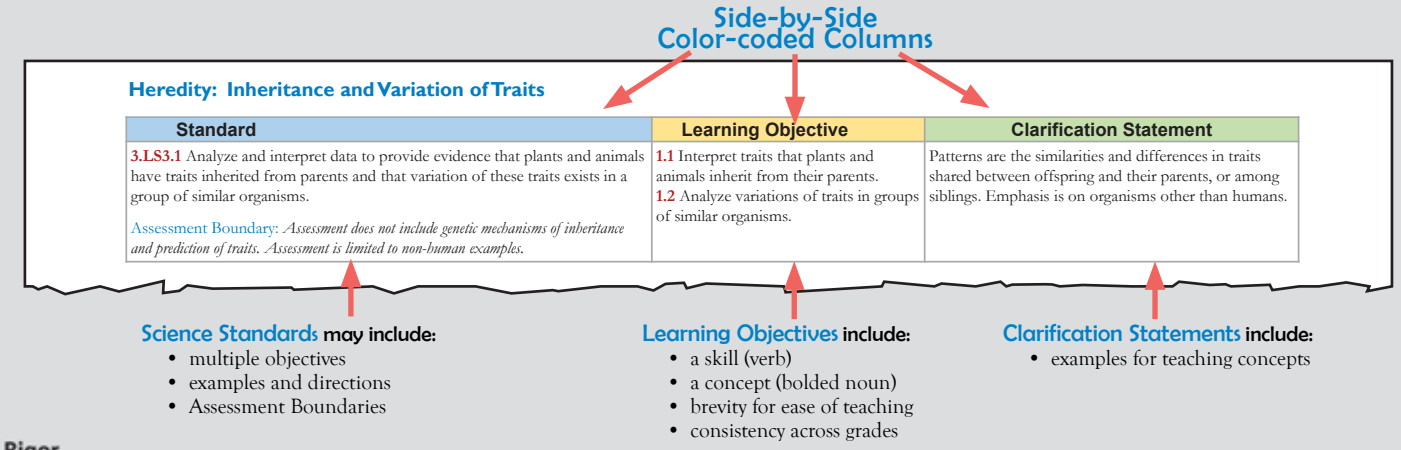
...Checklist for evaluating student writing samples (Literacy).

...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



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

Grade 2 – Physical Science

Matter and Its Interactions

Standard	Learning Objective	Clarification Statement
2.PS1.1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. Assessment Boundary: *None.*	**1.1** Describe **matter**. **1.2** Classify **matter**.	Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.
2.PS1.2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. Assessment Boundary: *Assessment of quantitative measurements is limited to length.*	**2.0** Determine which material is best for a purpose.	Examples of properties could include strength, flexibility, hardness, texture, and absorbency.
2.PS1.3 Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.	**3.0** Describe how the **pieces of an object can create a new object**.	Examples of pieces could include blocks, building bricks, or other assorted small objects.
2.PS1.4 Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. Assessment Boundary: *None.*	**4.1** Determine if the **changes caused by heating can be reversed**. **4.2** Determine if the **changes caused by cooling can be reversed**.	Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.

Grade 2 – Life Science

Ecosystems: Interactions, Energy, and Dynamics

Standard	Learning Objective	Clarification Statement
2.LS2.1 Plan and conduct an investigation to determine if plants need sunlight and water to grow. Assessment Boundary: *Assessment is limited to testing one variable at a time.*	**1.1** Investigate **plants' need for sunlight**. **1.2** Investigate **plants' need for water**.	Not available.
2.LS2.2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. Assessment Boundary: *None.*	**2.1** Describe how **animals disperse seeds**. **2.2** Describe how **animals pollinate plants**.	Not available.

Grade 5 – Earth & Space Sciences

Earth's Place in the Universe

Standard	Learning Objective	Clarification Statement
5.ESS1.1 Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth. Assessment Boundary: *Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).*	**1.0** Explain differences in **brightness of stars**.	Not available.
5.ESS1.2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. Assessment Boundary: *Assessment does not include causes of seasons.*	**2.0** Describe **patterns of daily changes due to Earth's orbit**.	Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.

Earth's Systems

Standard	Learning Objective	Clarification Statement
5.ESS2.1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. Assessment Boundary: *Assessment is limited to the interactions of two systems at a time.*	**1.0** Describe the way **Earth's systems** interact.	Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.
5.ESS2.2 Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. Assessment Boundary: *Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.*	**2.0** Describe the **distribution of water on Earth**.	Not available.

Earth and Human Activity

Standard	Learning Objective	Clarification Statement
5.ESS3.1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. Assessment Boundary: *None.*	**1.0** Explain how communities protect the **Earth's resources and environment**.	Not available.

From Molecules to Organisms: Structures and Processes

Standard	Learning Objective	Clarification Statement
MS.LS1.5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. Assessment Boundary: *Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.*	**5.1** Explain how **environmental factors influence the growth of organisms**. **5.2** Explain how **genetic factors influence the growth of organisms**.	Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.
MS.LS1.6 Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. Assessment Boundary: *Assessment does not include the biochemical mechanisms of photosynthesis.*	**6.0** Explain the **role of photosynthesis**.	Emphasis is on tracing movement of matter and flow of energy.
MS.LS1.7 Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. Assessment Boundary: *Assessment does not include details of the chemical reactions for photosynthesis or respiration.*	**7.0** Describe how **food is rearranged through chemical reactions**.	Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.
MS.LS1.8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. Assessment Boundary: *Assessment does not include mechanisms for the transmission of this information.*	**8.0** Describe how **sensory receptors respond to stimuli**.	Not available.

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 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..
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 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 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 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.

Academic Vocabulary – 5th Grade Science
(from the Next Generation Science Standards)

connection (2) – link, relationship

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

A

apparent – clearly visible
aspects – particular qualities

C

communities – groups of individuals living in the same area
conduct – perform
constraints (2) – limitations
criteria (2) – principles or standards by which something may be judged

D

data – information about something
define – describe the meaning of
design – *v.* to create a plan that shows the look, function, or workings of something.
displays – shows information visually
distribution – spread out over the planet

E

evidence (2) – facts that prove or disprove something; proof

Content Vocabulary – 5th Grade Science
(from the Next Generation Science Standards)

graph (2) – a picture or drawing that represents data

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

A

atmosphere – the envelope of gas surrounding a planet

B

biosphere – the regions of a planet, particularly the Earth, that are occupied by living organisms

C

conserved – not changed; maintained, or protected
cooling – lowering temperature

D

decomposers – organisms that break down dead tissue

E

energy – property of matter and radiation that has the capacity to perform work
environment (2) – the surroundings or conditions that an organism lives in
exerted – applied; put into vigorous use

Academic Vocabulary – High School Science
(from the Next Generation Science Standards)

connection (2) – link, relationship

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

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

Content Vocabulary – High School **Physical Science**
(from the Next Generation Science Standards)

mathematical (5) – based upon math

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

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

Conservation of Momentum

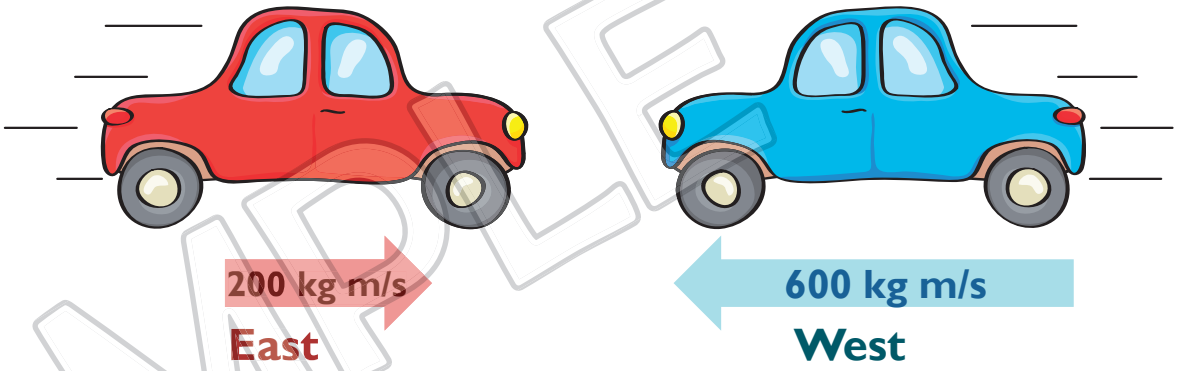
Total momentum of a closed system is constant

Momentum Before

600 kg m/s West

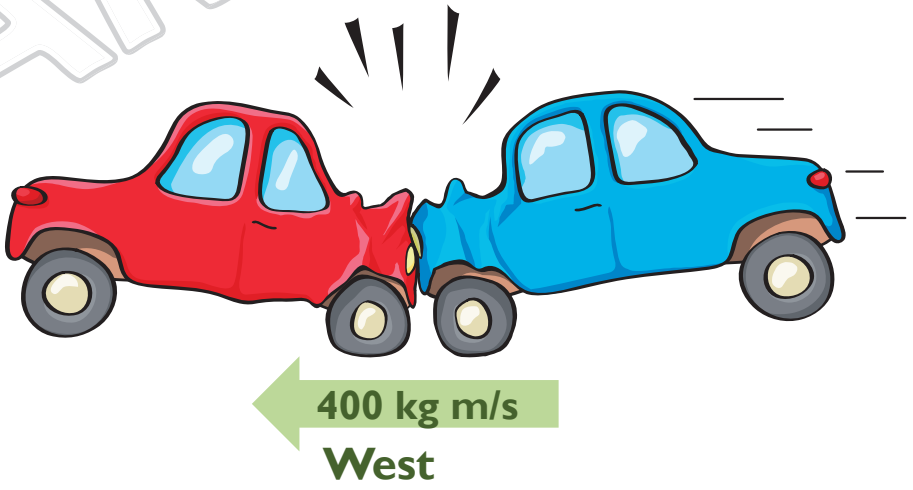
– 200 kg m/s East

400 kg m/s West



Momentum After

400 kg m/s West

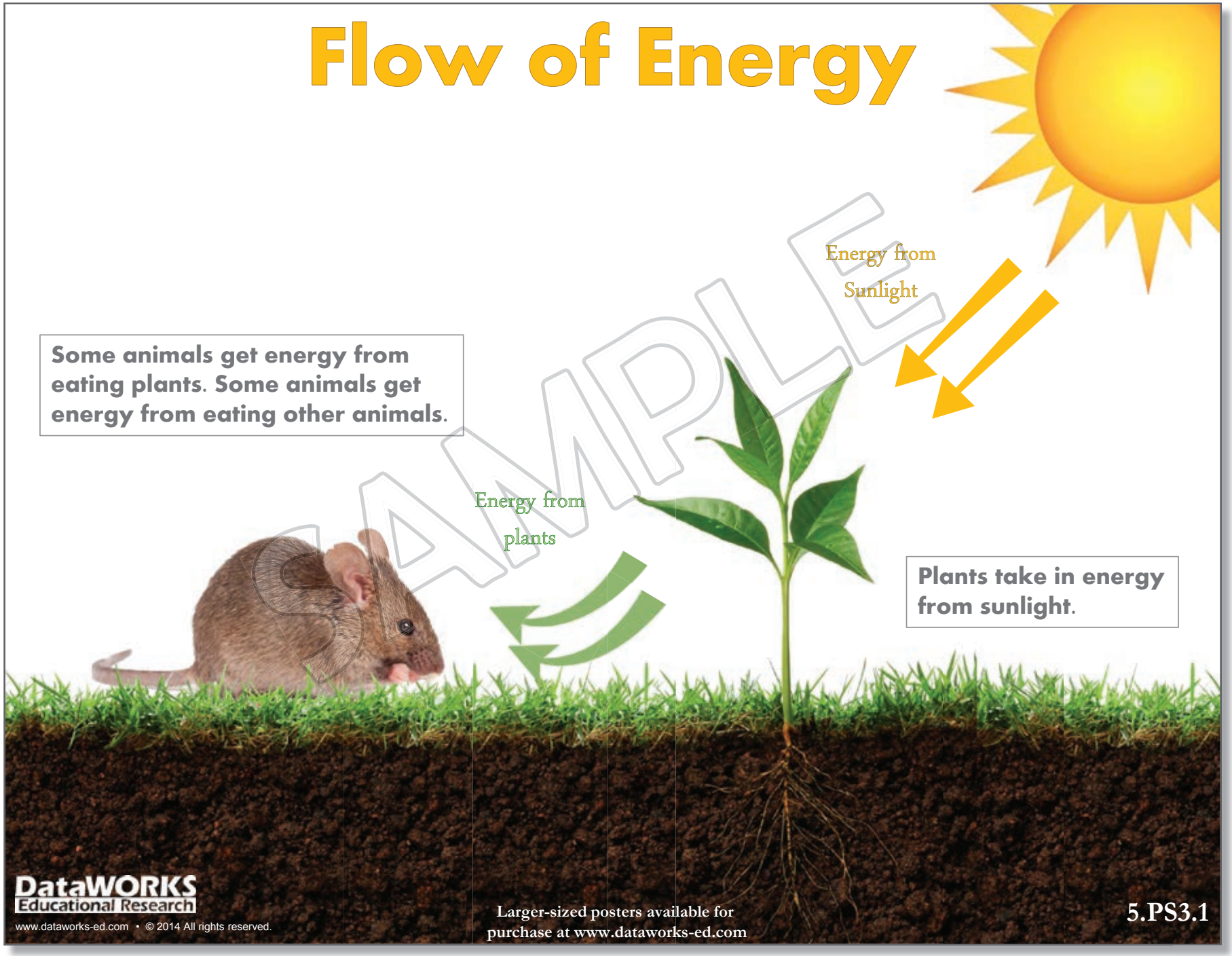


DataWORKS Educational Research

Larger-sized posters available for purchase at www.dataworks-ed.com

HS.PS2.2

Sample Mini-Poster
(Supplemental Material)



Sample Mini-Poster
(Supplemental Material)

Observation of Matter

Stone

Color: Grey

Texture: Rough

Hardness: Hard

Flexibility: Not flexible

Cotton ball

Color: White

Texture: Fluffy, smooth

Hardness: Soft, squishy

Flexibility: Stretchable, bendable

2.PS1.1

Sample Mini-Poster
(Supplemental Material)

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

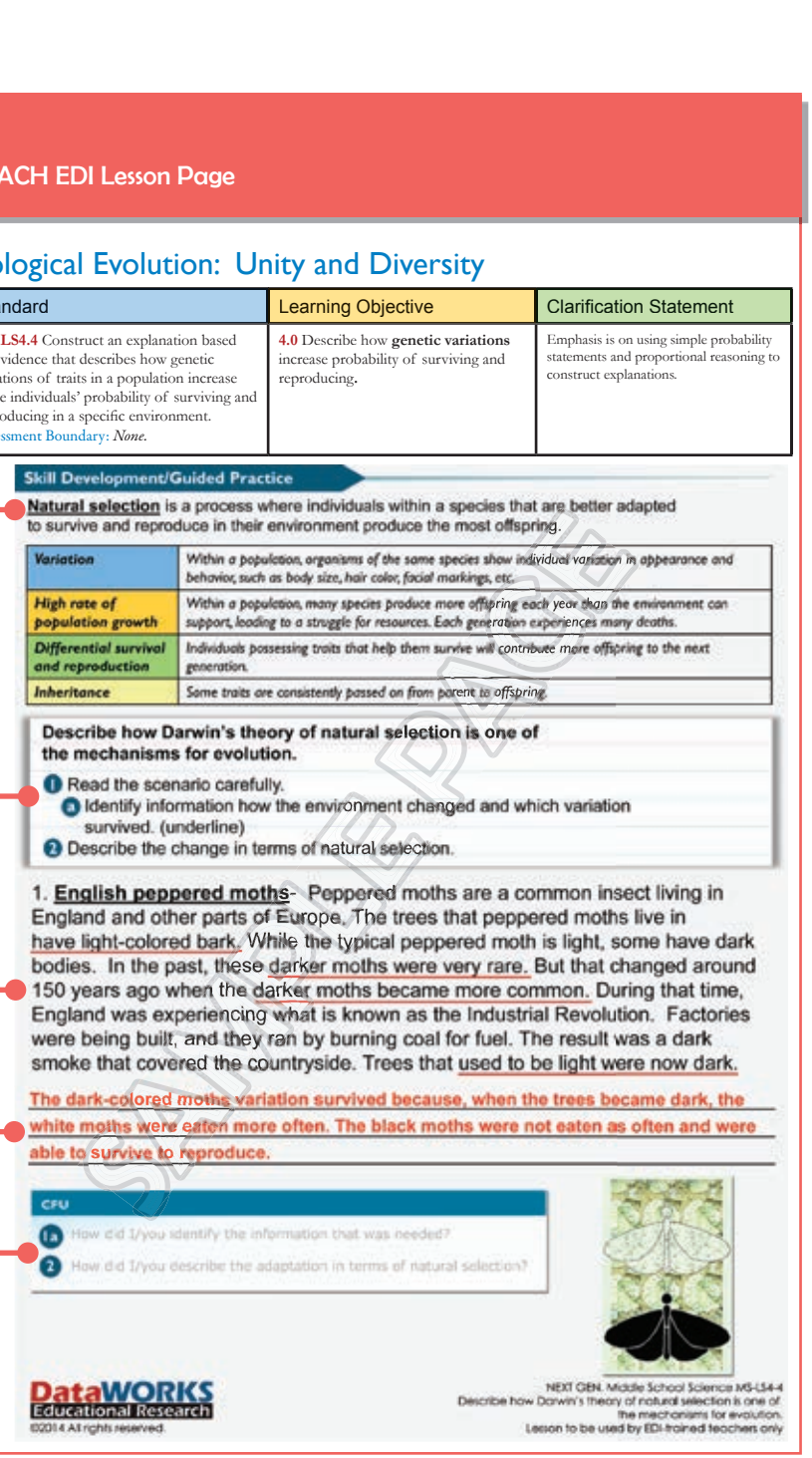
Building Knowledge
Clear Conceptual Definitions

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

How to Purchase a Learning Objective Guide

1. Purchase digital guides on our online store by using our eCommerce store: https://store.dataworks-ed.com.
2. Purchase printed guides by calling us at (800) 495-1550 M - F 8 am - 5 pm PST.

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.

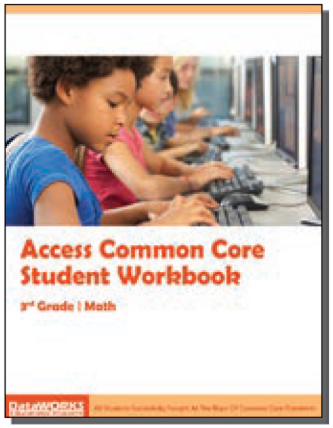
Other Teacher Resources offered by DataWORKS:

NEW

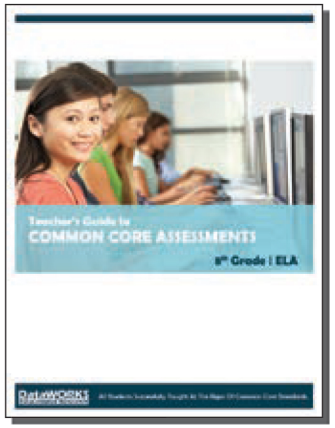
educeri

www.educeri.com

Lesson Plans



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)