Closing the Gap in Science Achievement on the TASC™

Focusing on Key Core Disciplinary Ideas: Life Science LS-2

Central/Southern Tier RAEN

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Learning Objectives

Currently, 36% of the TASC™ Science section assesses Life Science content and practices…

1. Understand which Indicators of the Framework of the Next Generation Science Standards represent the gap between passing and non-passing students on the TASC
2. Use strategies and resources to engage students in science content in one indicator: Life Science Standard 2 (LS2)- Ecosystems: Interactions, Energy, and Dynamics, identified in the Greatest Achievement Gap report.
3. Experience some hands-on activities to support students in this indicator.

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Agenda

- Objectives
- Introductions
- Where we are now…
- Revised Structure of the TASC™
- TASC™ Gap Analysis
- The Next Generation Science Standards Organization
- Hands-on Practice with LS-2
  - Honey Bee Colony Collapse Disorder - Using ELA in the Science Content Area
  - Oh Deer: Carrying Limiting Factors and Carrying Capacity in Populations

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Where We Are Now…

Turn and Talk about TASC Science

- What successes have your students had?
- What challenges do they face?
- What are you wondering…

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TASC™ Science Structure*

	TASC
Content Area	
• Physical Sciences	36%
• Life Sciences	36%
• Earth and Space Sciences	28%
• Scientific and Engineering Practices	Integrated
• Cross-Cutting Concepts	Integrated
Testing Time	85 min (90 min Spanish)
Number of Questions	48/49 MC (8 stimuli) 1 Constructed Response 1 Technology-Enhanced Item

* as of March, 2015

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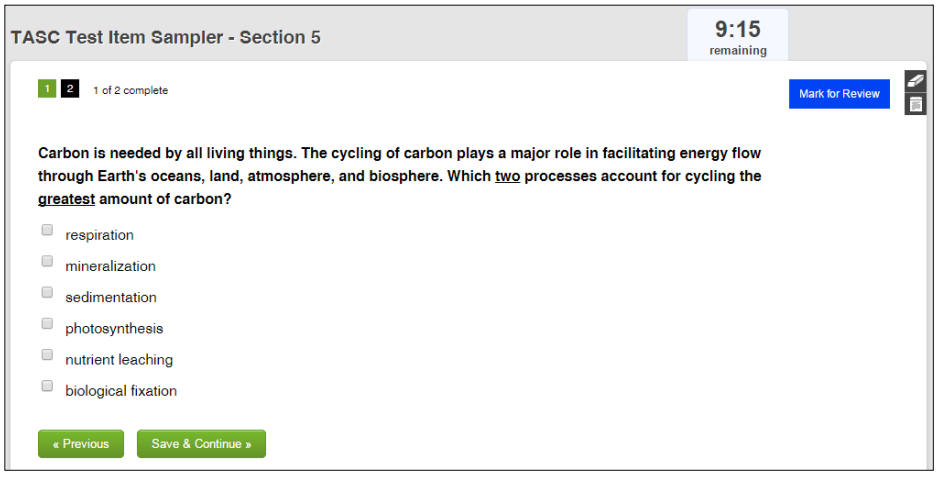
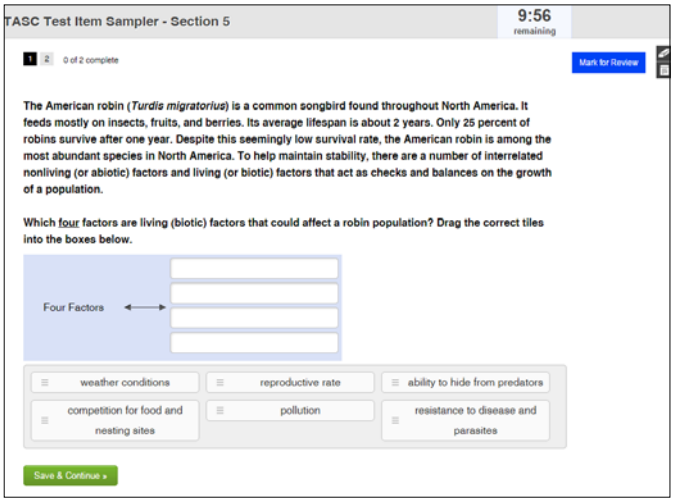
Sample Technology-Enhanced Test Item



Sample Technology-Enhanced Test Item



TASC™ Readiness Test Observations

Knowledge Required	% Questions
Prior Knowledge Required	70%
Cross-Cutting Concepts (cause-and-effect, proportion)	78%
Computation	35%

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TASC™ Science Structure

- Includes items for the disciplines of Physical Sciences, Life Sciences, and Earth and Space Sciences.
- Each discipline is subdivided into several Core Ideas
- Each Core Idea contains multiple performance expectations.

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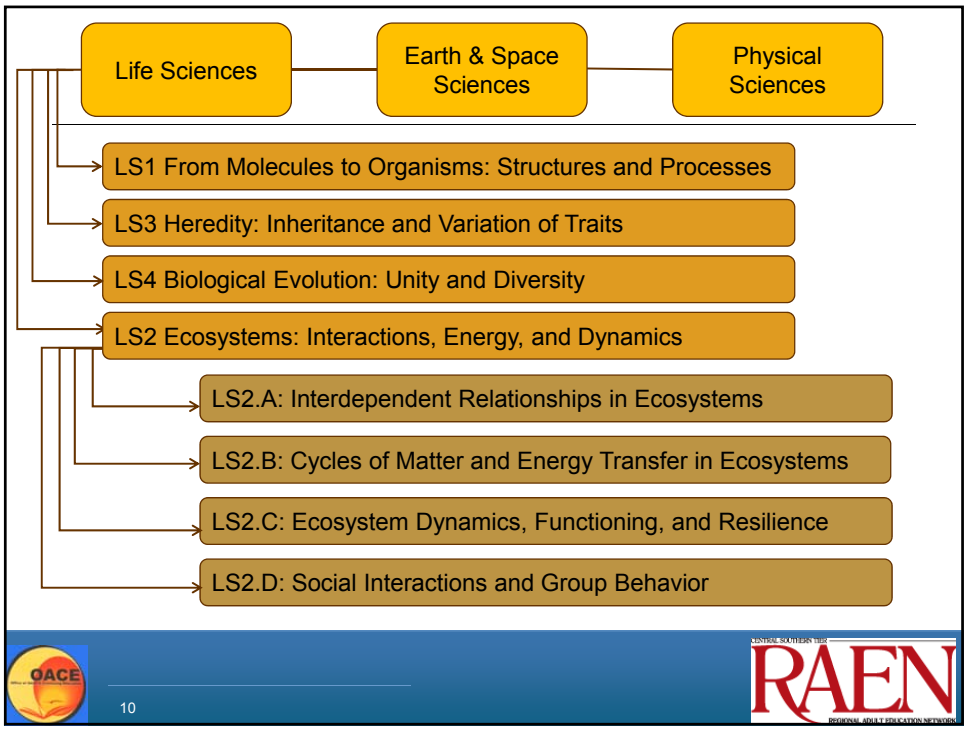

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TASC™ Science Disciplinary Core Ideas

Life Sciences
- LS1 From Molecules to Organisms: Structures and Processes
- LS2 Ecosystems: Interactions, Energy, and Dynamics
- LS3 Heredity: Inheritance and Variation of Traits
- LS4 Biological Evolution: Unity and Diversity

Earth and Space Sciences
- ESS1 Earth's Place in the Universe
- ESS2 Earth's Systems
- ESS3 Earth and Human Activity

Physical Sciences
- PS1 Matter and Its Interactions
- PS2 Motion and Stability: Forces and Interactions
- PS3 Energy
- PS4 Waves and Their Applications in Technologies for Information Transfer

Core Ideas build from ES to MS to HS

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TASC™ Test Science

- The number of test items per Core Idea is proportional to the number of performance expectations within the Core Idea. For example,
  - Life Science Core Idea 1: From Molecules to Organisms: Structures and Processes has 8 Indicators
  - Life Science Core Idea 2: Ecosystems: Interactions, Energy, and Dynamics has 5 Indicators
- Therefore, expect more questions testing Core Idea 1 than Core Idea 2.

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TASC™ Science Gaps

Maxine McCormick's Common Core Achieve resources page:
http://maxinemccormick.com/tasc/tasc-cc-achieve-9-12/

Items that Present the Greatest Achievement Gap Between Passing and Non-Passing TASC Test Examinees

Data from the 2014 administration of the **Test Assessing Secondary Completion™** was analyzed to identify skills in each content area that were most consistently demonstrated by examinees that passed the TASC test, compared to students that did not pass the TASC test. The analysis was conducted as follows:

First, the p-value* for each item was estimated for examinees who passed the TASC test and for examinees that did not pass the TASC test. Items were identified in each content area with the largest difference in p-value between passing and non-passing examinees. Next, McGraw-Hill Education CTB Content experts selected a minimum of 3 standards per objective with the greatest difference in p-value between passing and non-passing examinees (and where the difference was at least .25). The skills identified in each subject area and objective, identified below, were selected as most representative of skills with the greatest achievement gap between passing and non-passing examinees.

** Percent of students responding correctly to an item*

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TASC™ Science Disciplinary Core Idea Gaps

Life Sciences
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- LS2 Ecosystems: Interactions, Energy, and Dynamics
- LS3 Heredity: Inheritance and Variation of Traits
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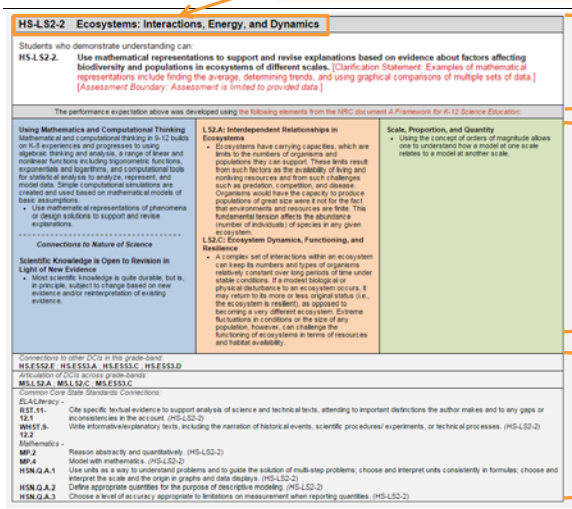
Next Generation Science Standards Organization

Title and Code: ***HS*** identifies this as High School, ***LS*** as Life Science



HS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

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.** [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Using Mathematics and Computational Thinking
Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.
- Use mathematical representations of phenomena or design solutions to support and revise explanations.

Connections to Nature of Science

Scientific Knowledge is Open to Revision in Light of New Evidence
- Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence.

LS2.A: Interdependent Relationships in Ecosystems
- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience
- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

Scale, Proportion, and Quantity
- Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale.

Connections to other DCIs in this grade-band:
HS.ESS2.E; **HS.ESS3.A**; **HS.ESS3.C**; **HS.ESS3.D**

Articulation of DCIs across grade-bands:
MS.LS2.A; **MS.LS2.C**; **MS.ESS3.C**

Common Core State Standards Connections:

ELA/Literacy -
RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-2)
WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS2-2)

Mathematics -
MP.2 Reason abstractly and quantitatively. (HS-LS2-2)
MP.4 Model with mathematics. (HS-LS2-2)
HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-2)
HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-2)
HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-2)

Performance Expectations: what students should be able to do to show mastery

Foundation Box: the Science and Engineering Practices, Disciplinary Core Ideas, and Cross-Cutting Concepts from the Framework for K-12 Science Education used to define the Performance Expectations above

Connections Box: Connections to other science standards within this grade band, articulations across grade bands, and connections to Common Core Standards in Mathematics and English Language Arts/Literacy

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Next Generation Science Standards Organization

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Disciplinary Core Idea Progression

Performance Indicator	ES Science	MS Science	HS Science
LS2.A: Interdependent Relationships			
LS2.B: Cycles of Matter			
LS2.C: Ecosystem Dynamics			
LS2.D: Social Interactions and Group Behavior			

What Do Students Need to Master at Each Level of the LS2 Performance Indicator?

How Does this Mastery Progress?

TASC™ Test Science

What are the implications of this GAP report information for

- Curriculum,
- Instruction, and
- Assessment?

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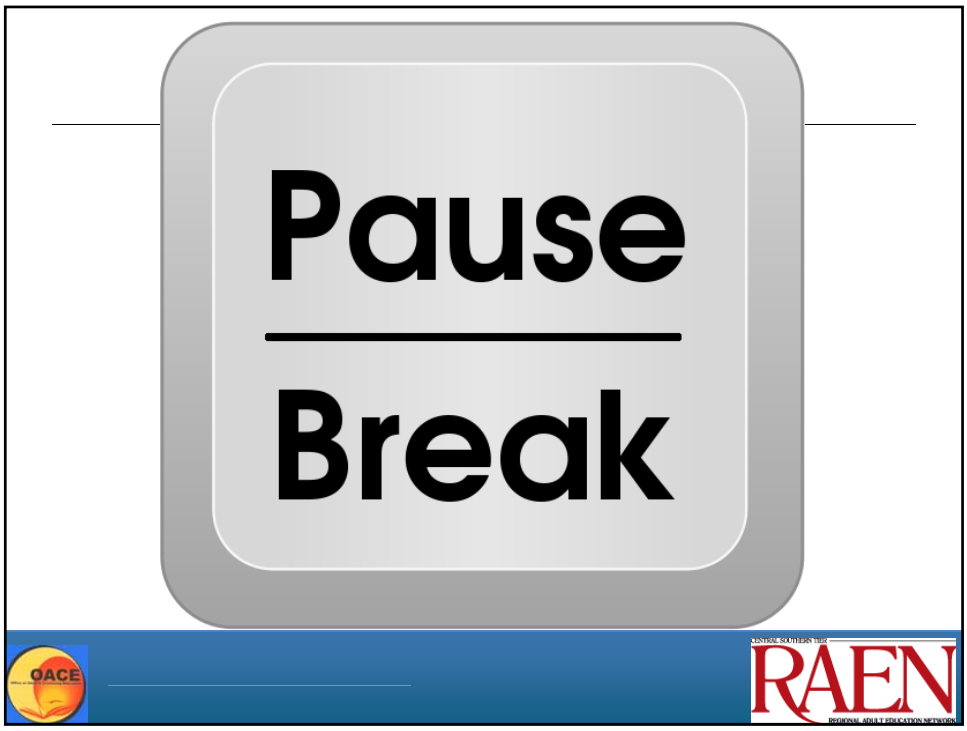


Honey Bee Colony Collapse Disorder
ELA in the Science Content Area

Objectives:

- Students understand the importance of mutual relationships in ecosystems.
- Students use guided questions to investigate Colony Collapse Disorder.
- Students summarize the issues associated with Colony Collapse Disorder.
- Students evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

Honey Bee Colony Collapse Disorder
ELA in the Science Content Area

Vocabulary review:

- *Ecosystem* - a system, or a group of interconnected elements, formed by the interaction of a community of organisms with their environment.
- *Food chain* - a series of organisms interrelated in their feeding habits, the smallest being fed upon by a larger one, which in turn feeds a still larger one, etc.
- *Food web* - a series of organisms related by predator-prey and consumer-resource interactions; the entirety of interrelated food chains in an ecological community.
- *Symbiosis* - The word ***symbiosis*** literally means 'living together,' but when we use the word *symbiosis* in biology, what we're really talking about is a *close, long-term interaction between two different species.* There are many different types of symbiotic relationships that occur in nature.

Ecosystems Quiz Lesson 1

Define:

- Ecosystem
- Symbiosis

Which of these is the primary source of energy plants use to produce their own food?

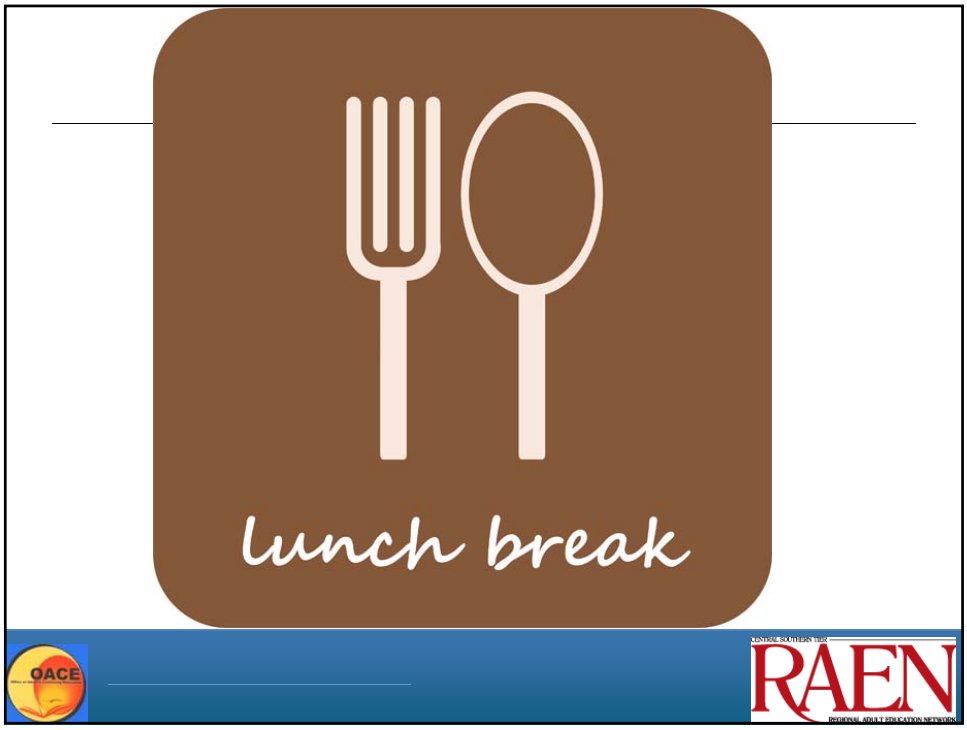
A. Consumer B. Sunlight C. A producer D. Rain

What must always come at the beginning of a food chain?

A. Consumer B. Prey C. Carnivore D. Producer

Give an example of a symbiotic relationship. Explain.

Honey Bee Colony Collapse Disorder
ELA in the Science Content Area



Which is the best summary of today's lesson? Why?

1. Bees and plants have a mutual symbiotic relationship…. Because there aren't enough flowers for the bees to make food…
2. Over the past 40 years, there has been a rapid decline in the number of bees world-wide. It is believed that loss and disruption of habitats, widespread use of multiple pesticides, and mite infestations in the beehives….
3. Large numbers of fruit and vegetable crops are disappearing because there aren't enough bees to pollinate them. The bees are dying because they are being poisoned with chemical pesticides.

Oh, Deer!

Overview & Objectives

- Students will become different components of an ecosystem and learn about habitat interactions in this kinesthetic learning activity. By graphing the results of this game, students can discuss topics in population dynamics, limiting factors, and carrying capacity.
- Students will understand animals' basic needs for survival: food, water, shelter, and space.
- Students will learn that limiting factors such as lack of resources or diseases naturally regulate animal populations.
- Students will understand that some population fluctuations are part of natural cycles.

Oh, Deer!

Vocabulary

- **carrying capacity:** the maximum population size of the species that the environment can sustain, given the food, habitat, water and other necessities available in the environment
- **limiting factors:** a factor that controls an organism's population, size, or distribution
- **habitat:** the natural environment in which an organism lives

Oh, Deer!

Brainstorm

- What do animals need to survive?
- What are some of the limiting factors?
- Do populations remain the same or change?

Oh, Deer Activity (pause)

Oh, Deer!

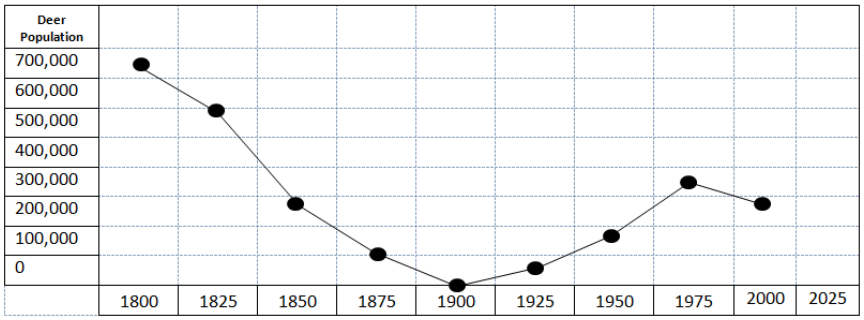
Brainstorm Revisit

- What do animals need to survive?
- What are some of the limiting factors?
- Do populations remain the same or change?
- What are other factors that might affect the deer population?

White Tails Activity (pause)

Carrying Capacity-Actual Data from White Tail

Year	1800	1825	1850	1875	1900	1925	1950	1975	2000	2025
Deer	700,000	550,000	250,000	75,000	0	25,000	150,000	350,00	250,000	?



Next Generation Science Standards Activities

Classroom Sample Tasks

Middle School Sample Tasks

- **Antibiotic Resistance**
- **Four Cities**
- **Ocean Waves** (PS2-3, PS4-1, PS4-2)
- **Watershed**

High School Sample Tasks

- **Analyzing Floods** (ESS3-5)
- **Bee Colony Numbers** (LS2-2)
- **Solar Cooker**
- **Sub-Zero**
- **Unraveling Earth's Early History**

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Scope, Sequence, and Coordination

http://dev.nsta.org/ssc/

The NSF-funded project on Scope, Sequence, and Coordination of Secondary School Science (SS&C) was initiated by the National Science Teachers Association (NSTA)

Scope, Sequence, and Coordination

Indicator	Skill/Description	SS&C Modules
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.	1002 Genetic Variability 1003 Structural Factors in Evolution
LS2-2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.	904 Adaptations to Niches and Habitats 955 Populations 956 Limiting factors for Populations
LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.	912 Animal Behavior

PBS Learning Media

Indicator	Skill/Description	PBS Learning Media Resources
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.	• Nova: Genetic Variation • Nova: Genetic Modification • Evolution Series: Genetic Tool Kit
LS2-2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.	• WGBH: Biodiversity in The Dzangha-Sangha Rain Forest • KET: Three Levels of Biodiversity
LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.	• Battle for The Elephants: Altered Elephant Behavior • WGBH: Animal Defenses

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Online Resources

- Next Generation Science Standards:
  http://www.nextgenscience.org/
  http://www.nextgenscience.org/classroom-sample-assessment-tasks
- PBS Learning Media
  http://ny.pbslearningmedia.org/
- Scope, Sequence, and Coordination Micro-units
  http://dev.nsta.org/ssc/
- CTB McGraw-Hill's TASC™ webpage:
  http://www.tasctest.com/
- Materials used in this Presentation:
  http://tinyurl.com/kxgwt58

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Online Resources

- Engrade TASC™ Sample Online Test Items

  https://www.engradepro.com/preview/?qk=f0da0dab1eb0a99790fe7de50058636b&section=1

  Students can now experience new technology-enhanced item types before test day. The interactive demo offers practice items just like those on the new D, E and F TASC test forms. Designed to familiarize students with technology-enhanced items, this dynamic new demo will increase test taker confidence and provide examinees with a simulated online test taking experience.
- Maxine McCormick's TASC™ Common Core Achieve resources:

  http://maxinemccormick.com/tasc/tasc-cc-achieve-9-12/

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TAPPS: Thinking Aloud Paired Problem Solving

Speaker:

- Flip over your postcard
- How does this image represent your takeaways from today?
- Say aloud everything you are thinking as you solve the problem

Listener:

- Take notes on what your speaker is saying
- Remind the speaker to talk if there is silence
- You may ask clarifying questions, but do not help solve the problem
- Be prepared to share what you heard

After one round, switch roles

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