Louisiana Believes

Science Field Test

Supervisor/Principal Collaboration
November 2017

DEPARTMENT of EDUCATION

Objectives

1. Participants will understand and be able to communicate
    a. the **vision** for the new Louisiana Student Standards for Science and how the new assessments support that vision,
    b. the **shifts** in classroom instruction necessary for student mastery of the new Louisiana Student Standards for Science, and
    c. the **field test design**, including item types and set-based design.
2. Each participant will brainstorm immediate and long-term supports for teachers throughout the session.

Agenda

1. Science Vision
2. New Assessment Supports Science Instructional Shifts
3. Field Test Design
4. Sample Test Items and Resources
5. Next Steps

Science Vision

LDOE Assessment Vision Supports Instruction

Science Instruction Vision: The Louisiana Student Standards for Science represent the knowledge and skills needed for students to **successfully transition to postsecondary educations and the workplace**.

The standards call for students to:

1. Apply content knowledge
2. Investigate, evaluate, and reason scientifically
3. Connect ideas across disciplines

Educator Support: The Department is committed to supporting each level of the system–teachers, principals, and school system leaders–by providing high-quality, standards aligned curriculum, **assessments**, and professional development **to help them continue to raise the bar** for students.

LDOE Assessment Vision:
We believe that all students can achieve, and we must measure their progress to ensure they **remain on track** for the next grade level and, **ultimately for college and professional careers**.

New Assessment Supports Science Instructional Shifts

Immediate and Long-Term Supports

As we move through this section, consider immediate and long-term supports needed to

(1) communicate the instructional and assessment shifts inherent in the new vision, and

(2) implement classroom changes to support multi-dimensional alignment of lessons and assessments.

Structure of the New Standards

MATTER AND ITS INTERACTIONS

Performance Expectation	Develop a model to describe that matter is made of particles too small to be seen.
Clarification Statement	Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, or evaporating salt water. Does not include atomic scale mechanism of evaporation and condensation or defining the unseen particles.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
1. Asking questions and defining problems 2. **Developing and using models:** Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Develop and/or use models to describe and/or predict phenomena. 3. Planning and carrying out investigations	**STRUCTURE AND PROPERTIES OF MATTER** Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including boiling water, the inflation and shape of a balloon, and the effects of air on larger particles or objects. (UE.PS1A.a)	**SCALE, PROPORTION, AND QUANTITY** Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods.

Performance Expectation and the Phenomenon

Performance Expectations (PE) define what students should be able to do by the end of the year.

Phenomena are real world observations that can be explained through scientific knowledge and reasoning.

Science Idea (not a phenomenon)	Scientific Phenomenon
Condensation	Water droplets form on the outside of a water glass.
Photosynthesis	Plants tend to grow toward their light source.
Types of Rocks	Different layers of rock can be seen on the side of the road.

Shift:

Apply Content Knowledge detailed in the Disciplinary Core Idea (DCI)

Disciplinary Core Idea

- **In the classroom**, students
  - develop skills and content knowledge
  - investigate and apply content knowledge to scientific phenomena
- **On the field test**, students
  - answer questions aligned to PE bundles (groupings of like PEs) and the corresponding DCIs
  - begin each set of questions by reading through stimulus materials connected to a scientific phenomenon

Shift:

Investigate, Evaluate, and Reason Scientifically as outlined in the Science and Engineering Practice (SEP)

Science and Engineering Practices

- **In the classroom**, students
  - do more than learn about science; they "do" science
  - instruction must integrate the practices, or behaviors, of scientists and engineers
  - investigate real-world phenomena and solve design problems
- **On the field test**, students
  - do more than answer recall questions about science
  - apply the practices, or behaviors, of scientists and engineers
  - investigate each real-world phenomenon and design solutions to given problems

Shift:

Connect Ideas Across Disciplines based on Crosscutting Concept (CCC)

Crosscutting Concept

- **In the classroom**, students
  - make connections across the domains of science: life science; physical science; earth and space science; environmental science; and engineering, technology, and applications of science
- **On the field test**, students
  - respond to sets of questions which assess application of knowledge across the domains of science for a comprehensive picture of student readiness for their next grade or course in science

Multi-Dimensional Alignment

PE and Phenomenon—What science skill does the student need to demonstrate? What is the context?

Multi-Dimensional Alignment:

DCI—What science domain does the skill meet?

SEP—What scientific or engineering behavior will the student need to use?

CCC—What concept does the student need to connect across science domains?

All items begin with one PE or pair of PEs and a phenomenon.

Items and Item Sets are aligned to at least 2 dimensions.

Task Sets are aligned to all 3 dimensions.

*i*LEAP Science Item

GLE 47—*Describe the difference between weather and climate*

Susan lives in a city where the days are usually very warm. However, yesterday was very cold. Which statement is true about the city yesterday?

A. The city had cold weather and climate.
B. The city had warm weather and climate.
C. The city had warm weather but a cold climate.
D. The city had cold weather but a warm climate.

While effectively applying the science practice of **engaging in argument from evidence**

by **making a claim about the merit of the solution cited by relevant evidence**,

the student demonstrates knowledge of the **steps humans can take to reduce the impacts of natural hazards**.

LEAP 2025 Sample Science Item

Tornadoes have very strong winds that can damage the roof of a house. Students study different design solutions to help reduce the damage caused by tornadoes. One student argues that the best design solution is to use thick metal straps to attach the roof of the house to the walls.

Which evidence **best** supports the student's claim that metal straps are the best design solution?

A. Houses with metal straps have more water damage than houses without metal straps.

B. Houses with metal straps have larger cracks in the roof than houses without metal straps.

C. Houses with metal straps have more dents in their roofs than houses without metal straps.

D. Houses with metal straps have less of their roof blown off than houses without metal straps.*

Key Goals for New Science Assessments

Starting in the 2018-2019 school year, students will take the LEAP 2025 science assessments, which provide

- questions that have been reviewed by Louisiana educators to ensure their alignment to the Louisiana Student Standards for Science (LSS for Science) and appropriateness for Louisiana students;
- measurement of the full range of student performance, including that of high- and low-performing students; and
- information for educators and parents about student readiness in science and whether students are “on track” for college and careers.

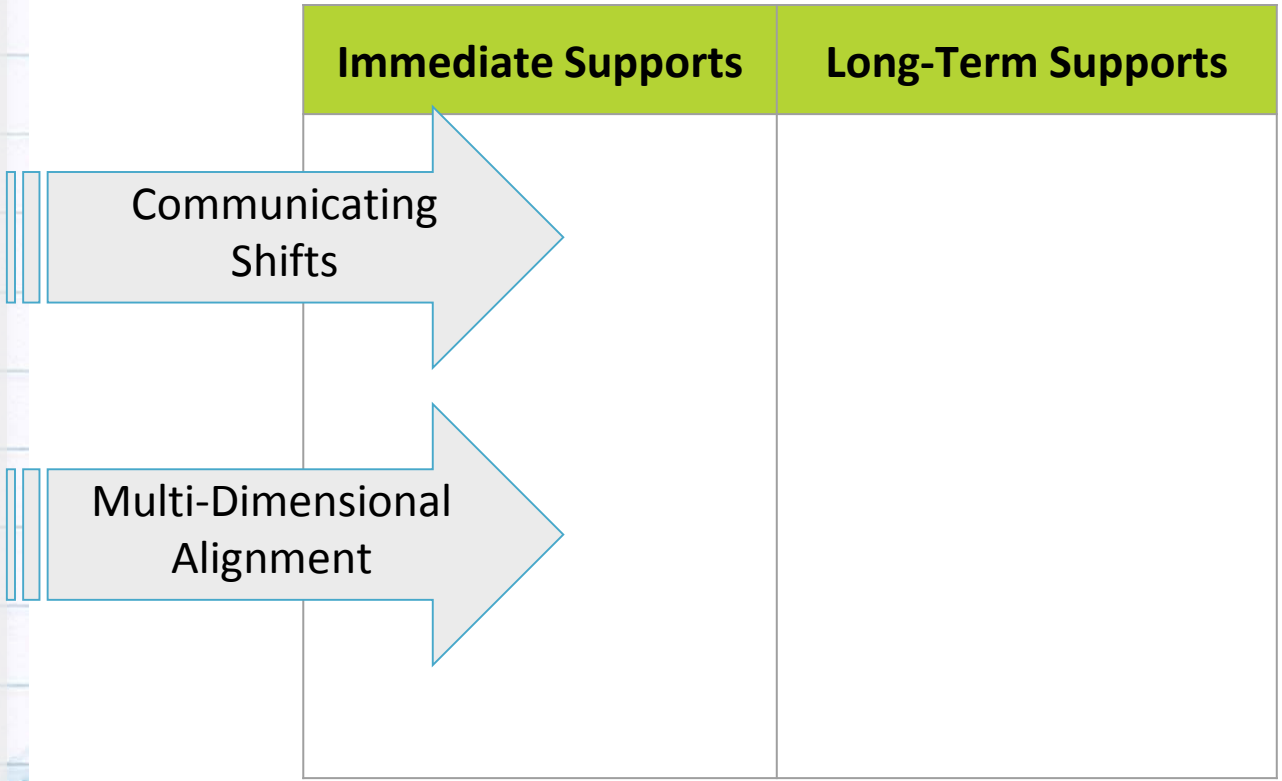
Brainstorm Supports

Take **5-7 minutes** to brainstorm immediate and long-term supports needed to:

(1) communicate the instructional and assessment shifts inherent in the new vision, and

(2) implement classroom changes to support multi-dimensional alignment of lessons and assessments.

Please plan to share out a few ideas.



Field Test Design

Features of the Science Field Test: Grades 3-8

No operational science test for grades 3-8, students take the science field test in Spring 2018. Features of the Science Field Tests

- two sessions
- timed
- same test window as LEAP 2025 grades 3-8 tests
- administered online for all grades, districts have the option for paper-based tests at grades 3 and 4
- all items reviewed by educator committees for multi-dimensional alignment to the LSS for Science and appropriateness for grade level and Louisiana students

Immediate and Long-Term Supports:

As we move through this section, consider immediate and long-term supports needed to communicate the field test design.

Field Test Design: Grades 3-8

	Session	Components	Time Allowed
Grades 3-4	**1**	2 item sets 3 discrete items	60 minutes
	2	1 task set	45 minutes

	Session	Components	Time Allowed
Grades 5-8	**1**	2 item sets 3 discrete items	60 minutes
	2	1 task set	55 minutes

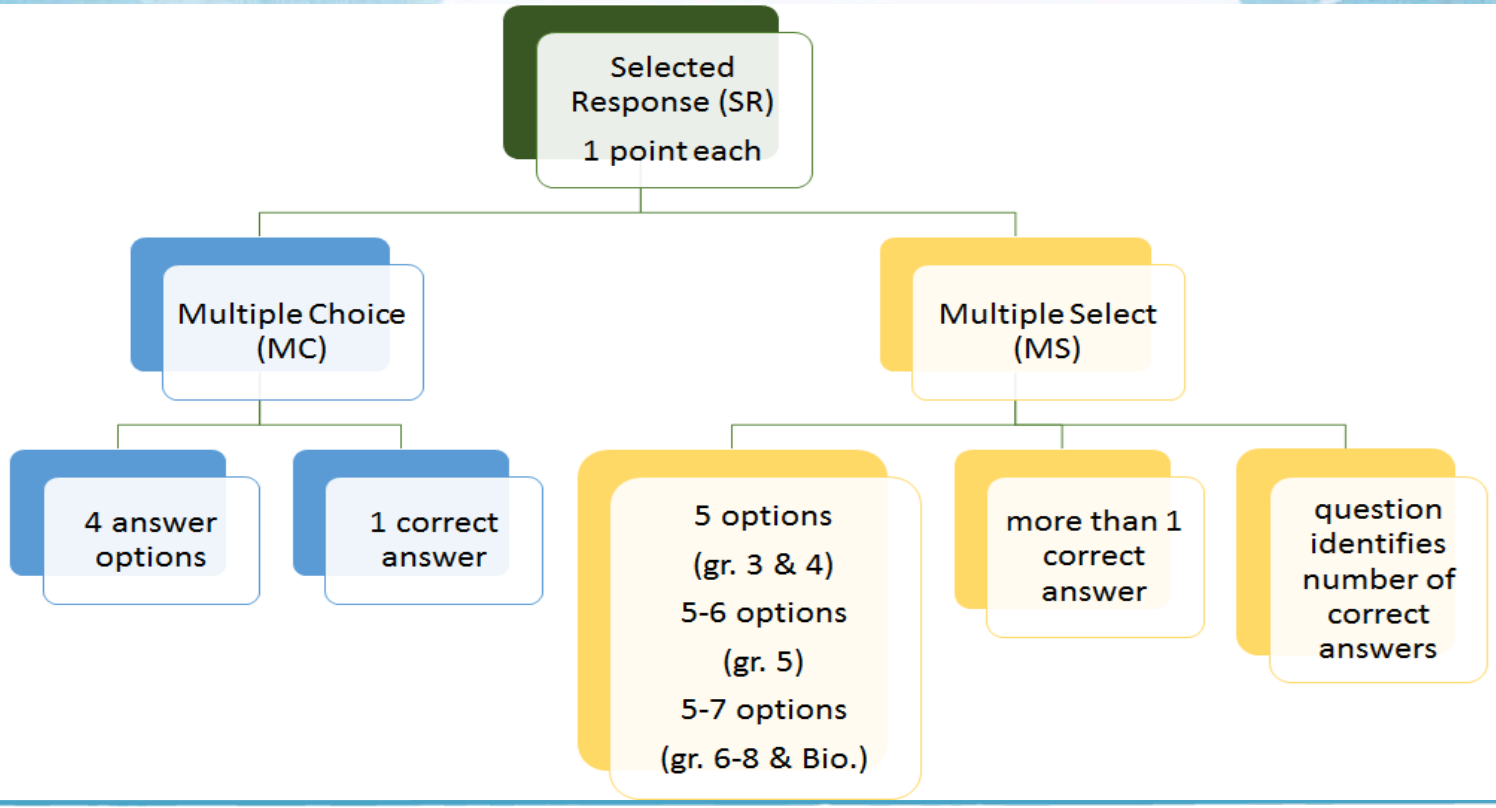
Biology Embedded Field Test

- Biology remains as four-level EOC test assessing the old GLEs
- Field test items aligned to the new LSS for Science will be embedded within each test session in the Spring 2018 administration only
- All embedded field test items reviewed and approved by educator committees for multi-dimensional alignment to the LSS for Science and appropriateness for course and Louisiana students
- Test remains untimed for 2017-2018

Biology Test Design with Embedded Field Testing

Session	Number of Operational Items	Embedded Field Test	Suggested Time
1	23 MC	1 item set 5 discrete items	60
2	2 MC & 1 CR	1 task set	60
3	23 MC	1 item set 4 discrete items	60

Item Types: Selected Response

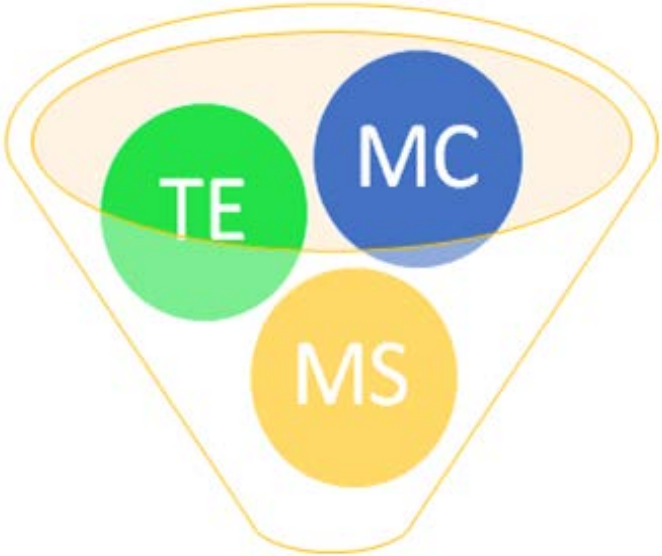


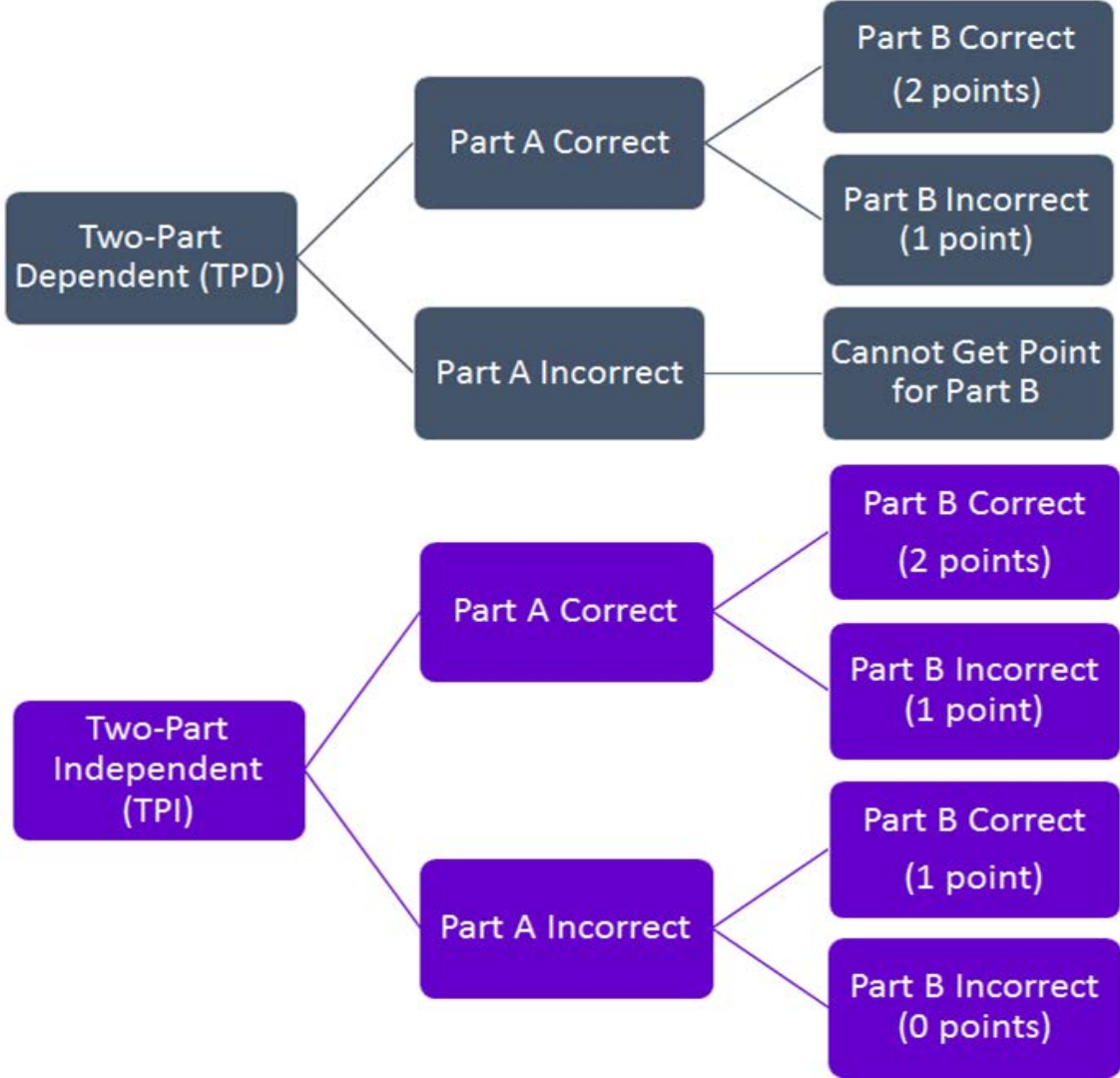
Item Types:
Technology Enhanced

Interactive items are designed to measure student abilities beyond selecting a response.

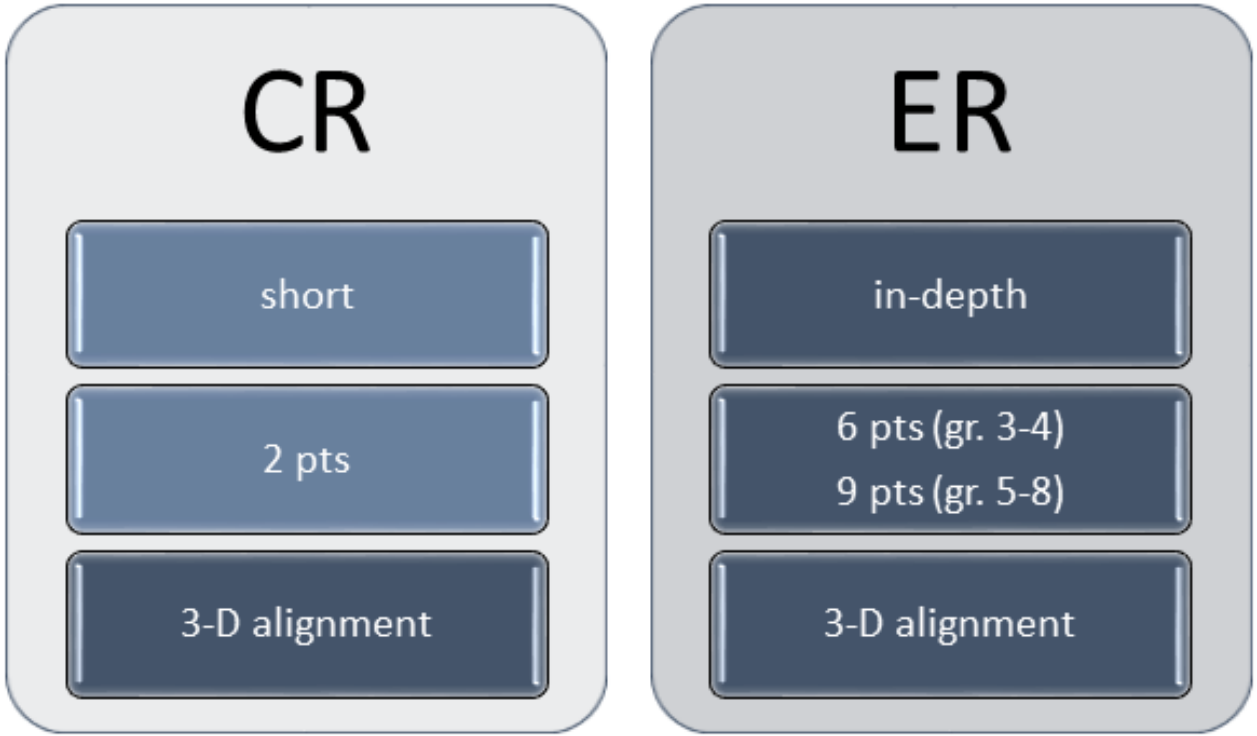
- **Drag and Drop**: allows students to select and move options around in different ways, such as moving information into a graphic or putting information in sequential order
- **Dropdown Menu**: allows students to open a list of answer options and select a choice, usually embedded in a sentence or within a paragraph containing multiple drop-down menus
- **Match Interaction**: allows students to select areas within a table
- **Hot Spot**: allows students to select areas within a graphic (e.g., map, fraction model)

Item Types: Two-Part Items





Item Types:
Constructed Response and Extended Response



Set-based Design

Set-based Design: Item Sets and Task Set

- scientific phenomenon provides the focus and context
- stimulus materials describe the scientific phenomenon
- comprised of four to five questions
- students use stimulus materials and course knowledge to answer the questions
- selected-response, technology-enhanced, and two-part questions
- some item sets culminate with a 2-point constructed-response
- a task set culminates with a 6- or 9-point extended-response

Brainstorm Supports

Take **5-7 minutes** to brainstorm immediate and long-term supports needed to communicate the field test design.

Please plan to share out a few ideas.

Immediate Supports	Long-Term Supports

Sample Field Test Items

Sample Field Test Sets

This section contains a sample item set for grade 4 and a sample task set for Biology, including information about

- multi-dimensional alignment with alignment analysis
- item types within each set
- answer keys and rubrics

Both the grade 4 item set and the Biology task set are available in the field test guides and in the OTTs. Each field test guide and OTT for grades 3-8 and Biology contains sample discrete items, item set, and task set.

Immediate and Long-Term Supports:

As we move through this section, consider immediate and long-term supports needed to prepare students for success on the science field tests.

Item Set:
How Bears See

Multi-Dimensional Alignment

4-PS4-2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

4-LS1-2 Construct an explanation to describe how animals receive different types of information through their senses, process the information in their brains, and respond to the information in different ways.

Item Type	PE	DCI	SEP	CCC	Points
MC	4-PS4-2	UE.PS4B.a	SEP 2 - MOD		1
MC	4-LS1-2		SEP 6 - E/S	CCC 2 - C/E	1
TPD	4-LS1-2	UE.LS1D.a	SEP 6 - E/S	CCC 2 - C/E	2
CR	4-PS4-2	UE.PS4B.a	SEP 2 - MOD	CCC 2 - C/E	2

Item Set:
How Bears See (Stimulus Materials)

Animals use their vision and other senses to help them find food. Comparing differences in animals' activities can help in understanding differences in their eyesight.

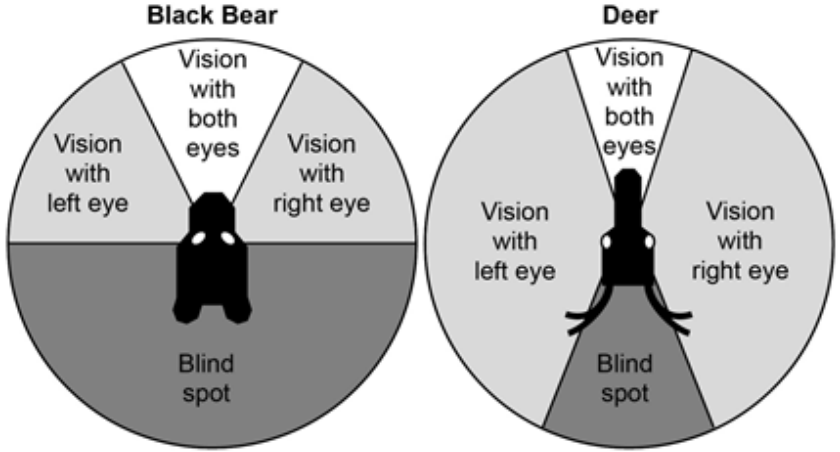
Table 1 shows some information about black bears and deer.

Table 1. Black Bear and White-Tailed Deer Facts

	Black Bear	Deer
Diet	plants, fruits, nuts, insects, fish, mammals	grasses, leaves, twigs, fruit, nuts
Behavior	mostly active at night; some activity during the day	active at dawn and at dusk
Predators	no natural predators	wolves, coyotes, mountain lions, bobcats

A blind spot is a place where an animal cannot see. Figure 1 shows the blind spots of a black bear and a deer.

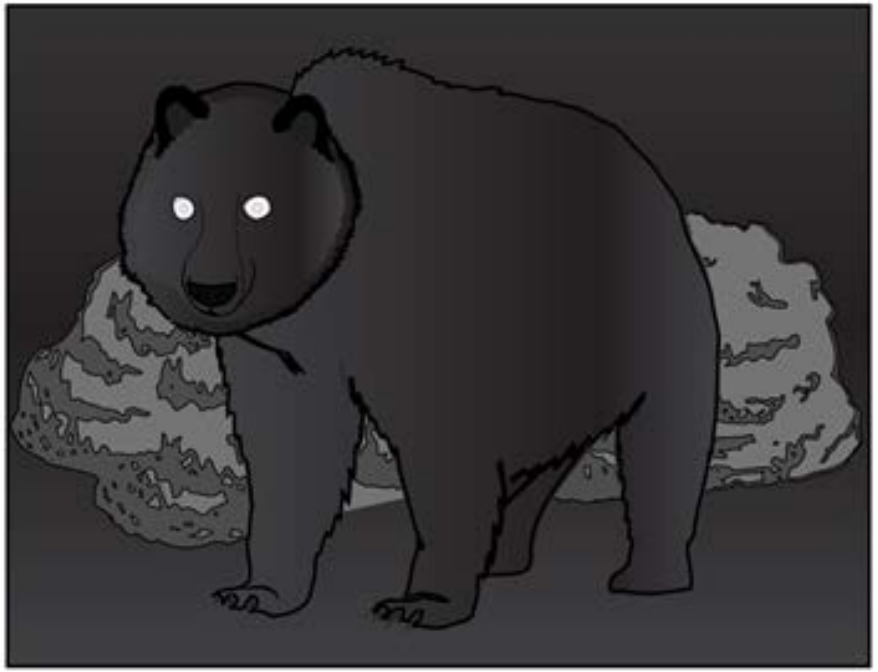
Figure 1. Black Bear and Deer Vision



Item Set:
How Bears See (Stimulus Materials, cont.)

Black bears can see well at night. This is because there is a thin layer of shiny material on the insides of their eyes. This helps their eyes capture more light and makes their eyes appear to glow at night, as shown in Figure 2.

Figure 2. Black Bear at Night



While effectively applying the science practice of using models

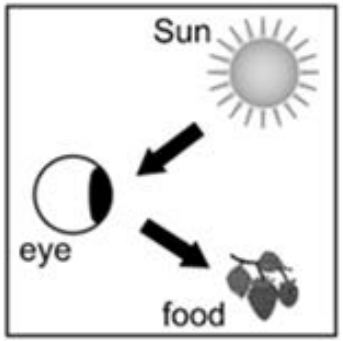
by **using a model to describe the path of light that allows a bear to see**,

the student demonstrates knowledge that **an object can be seen when light reflected from its surface enters the eyes**.

Item Set: How Bears See

Which model shows the path of light that allows a bear to see its food during the day?

A.



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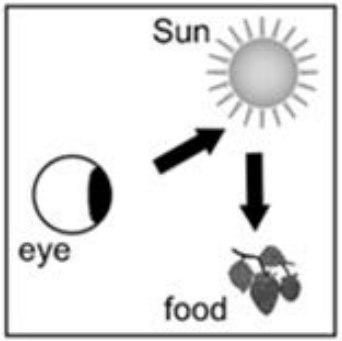
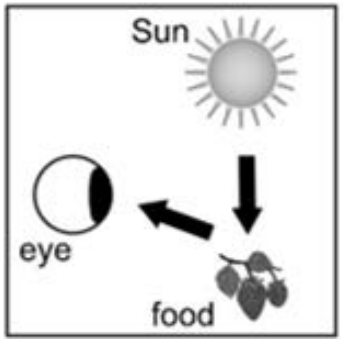
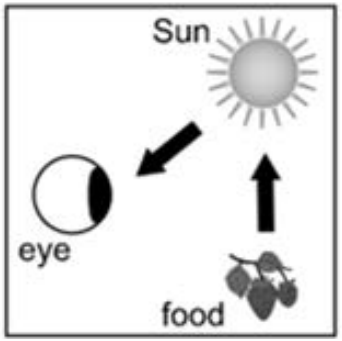


C.



D.



While effectively applying the science practice of **constructing explanations**

by **explaining observed relationships between light and the bear's eye**,

the student demonstrates an understanding of **cause and effect relationships**.

Item Set: How Bears See

Which sentence **best** explains what causes a bear's eyes to appear to glow at night, as shown in Figure 2?

A. Light is transmitted from objects to the bear's eyes.

B. Light is produced by the bear's eyes at night.

C. Extra light is stored in the bear's eyes during the daytime.

D. Extra light captured by the bear's eyes is reflected back out of the eyes.*

The item requires the student to apply the science practice of **constructing explanations**

and knowledge that **different sense receptors are specialized to allow animals to process particular kinds of information**

to demonstrate an understanding of **cause and effect relationships**.

Item Set: How Bears See

Part A

Which statements explain why bears and deer need different information to help them survive? Select the **two** correct answers.

A. Deer need to find food at night.
B. Bears need to find food that they cannot see.
C. Deer need to know if there are predators nearby.*
D. Deer need to travel long distances to find enough food.
E. Bears need to see prey such as fish so that they can catch them.*

Part B

Which statement supports the answers to Part A?

A. Bears have paws that can identify textures, but deer do not.
B. Deer have tongues that detect sweetness, but bears do not.
C. Deer have eyes that see almost all around them, but bears have eyes that see mostly in front of them.*
D. Bears have small ears that can turn in different directions, but deer must turn their heads to hear sounds.

The item requires the student to apply the science practice of **using models**

and knowledge that **an object can be seen when light reflected from its surface enters the eyes**

to demonstrate an understanding of **cause and effect relationships**.

Item Set: CR

A bear is hunting during a night with a full moon. A large cloud moves in front of the moon and blocks the light. Explain whether the bear can see better before the cloud covers the moon or after the light is blocked. Support your answer with evidence about how a bear is able to see and how a change in the amount of light affects the bear's vision.

Scoring:
Student's response correctly explains whether the bear can see better before the cloud covers the moon or after the light is blocked AND uses evidence to support the explanation.

Sample Response:
The bear cannot see after the light is blocked because light has to reflect off food and go into a bear's eye. If there is no light from the moon, then light cannot go into the bear's eye.

Task Set:
Bee Communication

Multi-Dimensional Alignment

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.

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Item Type	PE	DCI	SEP	CCC	Points
TEI	HS-LS1-2	HS.LS1A.b	2. MOD		2
MS	HS-LS1-1	HS.LS1A.c	6. E/S		1
MC	HS-LS1-1	HS.LS1A.a		S/F	1
TEI	HS-LS1-2	HS.LS1A.b	2. MOD		2
ER	HS-LS1-1; HS-LS1-2	HS.LS1A.c; HS.LS1A.b; HS.LS1A.a	6. E/S; 2. MOD	S/F; SYS	9

Task Set:
Bee Communication (Stimulus Materials)

Insects communicate with one another in different ways. Some insects communicate through the use of chemical signals called pheromones. There are many different types of pheromones used by insects. Bees have one of the most advanced pheromone-based communication systems. An individual bee can have up to fifteen different glands, and each gland can produce a collection of different pheromones. Bees also have sensory glands, such as antennae and mouth parts that detect different pheromones in the environment.

Queen bees use pheromones to control the behavior of the bees in a colony. Pheromones help coordinate activities among bees. Individual bees release different pheromones in response to different stimuli. Colonies without queen bees become stressed and collapse.

Task Set:
Bee Communication (Stimulus Materials, cont.)

Picture 1 shows an example of a bee colony swarming in response to queen bee pheromones. When the queen bee becomes trapped in a car, she emits pheromones, and bees from her colony swarm the car in an attempt to rescue her. Bees make specific proteins that bind to different pheromones. When proteins bind to a pheromone, a response is triggered in the bee.

Picture 1. Bee Colony Swarm

Source: Dai Roberts.

Examples of bee responses include:

- location detection
- sexual attraction
- direction of a flying swarm
- the calming of a landed swarm
- queen replacement
- defense alarms
- attack-site location
- signals that trigger attack

Individual bees that lack specific proteins or that have malformed proteins are unable to detect and respond to certain pheromones.

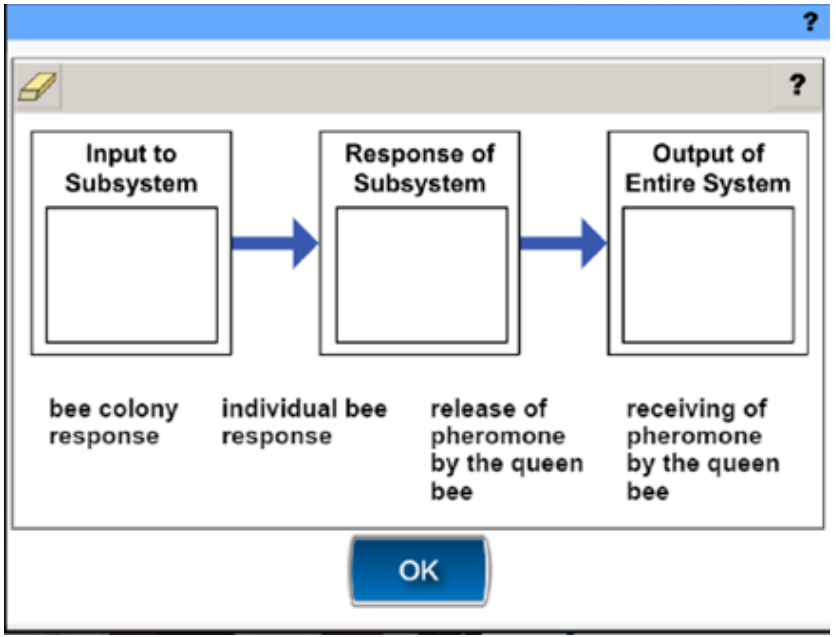
While effectively applying the science practice of **developing and using models**

by **illustrating the relationship between components of a system**,

the student demonstrates knowledge of **how multicellular organisms have a hierarchical structure where systems are made up of numerous parts**.

Task Set: Bee Communication

Bee colonies are an example of biological systems. The input of a subsystem affects the output of the entire system. Drag the correct phrase into **each** box to represent a subsystem-system relationship that causes a bee colony to swarm. Not all phrases will be used.



While effectively applying the science practice of **constructing explanations**

by **using valid and reliable evidence to form an explanation of scientific phenomena**,

the student demonstrates knowledge of **how all cells contain genetic information in the form of DNA** and **that genes found in DNA code for specific proteins, which carry out the essential functions of life**.

Task Set: Bee Communication

A student claims that DNA determines the structures of pheromone-detecting proteins in bees. Which evidence **best** supports the student's claim? Select the **two** correct answers.

A. Bee cells contain both DNA and pheromone-detecting proteins.

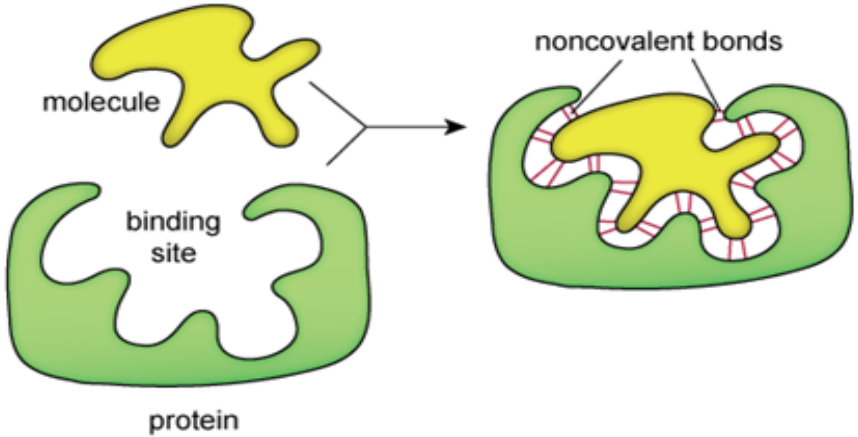
B. A single bee can produce multiple pheromone-detecting proteins.

C. Bee DNA contains unique genes for each pheromone-detecting protein.*

D. The queen bee contains more DNA than other bees that receive pheromone signals.

E. A mutation in a bee gene causes a change in the function of a pheromone-detecting protein.*

Task Set:
Bee Communication



A student makes a model to show how the structure of a protein allows it to bind to a molecule. The student's model is shown. Which pair of statements explains how the student's model shows how bees produce different responses to different pheromones?

A. The large and irregular binding site allows a variety of different pheromones with different shapes to bind with a specific protein. Different responses to different pheromones can be produced by a single protein.

B. The unique shape and size of the binding site allows only one pheromone with a specific shape to bind with a specific protein. Different responses to different pheromones are produced by different proteins.*

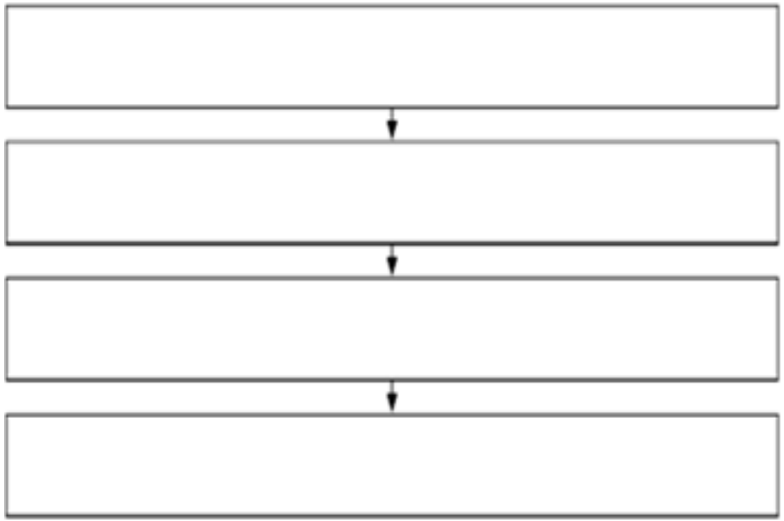
C. A protein changes the shape of a pheromone by forming covalent bonds at the binding site. This allows the protein to produce different responses.

D. A pheromone changes the shape of the binding site of a protein by forming covalent bonds. This allows the pheromone to produce different responses.

The item requires the student to apply knowledge of **the systems of specialized cells within organisms** to demonstrate an understanding of **structure and function**.

Task Set:
Bee Communication

Drag the statements into the correct boxes to model how a pheromone triggers a swarming response in a bee colony.



A swarming response is triggered in the individual bee.

A pheromone molecule attaches to the binding site of a specific protein.

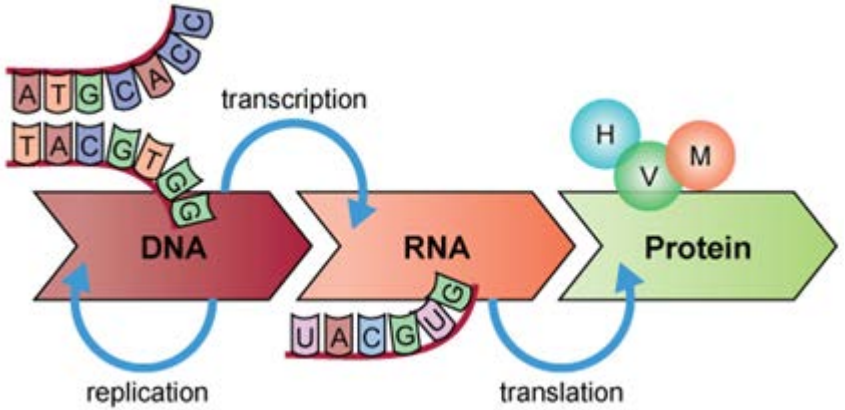
The queen bee sends out specific pheromone molecules that indicate she is in danger.

The pheromone molecule from queen bee is absorbed by a sensory gland of an individual bee.

While effectively applying the science practice of **developing and using models** by **illustrating the relationship between components of a system**, the student demonstrates knowledge of **how multicellular organisms have a hierarchical structure where systems are made up of numerous parts**.

Task Set:
Bee Communication

Many natural systems are involved in the biological organization of an individual bee. These systems interact to allow the individual bee to survive in its environment and contribute to the well-being of the entire bee colony. The model shown can be used to explain how a bee's cell structures use information in DNA to produce specific proteins that can bind to specific pheromones.



As you respond to Part A and Part B, follow the directions below.

Address all of the instructions in each prompt.

Use evidence from the information provided and your own knowledge of science to support your responses.

Task Set:
Bee Communication

Part A

Explain how the structure and function of nucleotides (DNA and RNA) allow the cell to assemble specific proteins with different structures and functions. In your answer, discuss the roles of:

- the DNA double helix structure
- nucleotide base pair bonding
- tRNA molecules

Use evidence from the model to support your answer.

Part B

Explain how the path from DNA to the swarming response in an individual bee involves a combination of biological systems at multiple scales. In your answer, describe the bee's biological systems that are involved in the swarming response, and explain how the systems work together to perform the response. Use evidence to support your answer.

Task Set:
Bee Communication

The item requires the student to apply the science practices of **constructing explanations** by **using valid and reliable evidence to form an explanation of scientific phenomena** and **developing and using models** by **illustrating the relationship between components of a system**, and knowledge of:

- **multicellular organisms have a hierarchical structure where systems are made up of numerous part**;
- **all cells contain genetic information (DNA) and genes found in DNA code for specific proteins, which carry out the essential functions of life**; and
- **systems of specialized cells within an organism help them perform the essential functions of life**

to demonstrate an understanding of **systems and system models** and **structure and function**.

Task Set:
Bee Communication

Score Points

An ER item may contain a single part or multiple parts. For multiple-part items: The student's score is the sum total of all the points earned across all parts (up to an item-maximum of 9 points) of the item. No response (blank) or a response that does not address the prompt earns 0 points.

Part A (6 points maximum)

- 3 points: 1 point for explaining the role of each of the following
  - the role of DNA double helix structure
  - the role of nucleotide base pair bonding
  - the roles of tRNA molecules
- 3 points: 1 point for using evidence to support each explanation

Part B (3 points maximum)

- 1 point for description of bee's biological systems
- 1 point for description of how multiple scales in biological systems are affected
- 1 point for explanation of how different biological systems work together

Task Set:
Bee Communication

Sample Response

Part A: DNA contains information to produce a protein. The information that codes for a protein is encoded in the order of nucleotides in a gene. The model shows that, during protein synthesis, the double helix structure unwinds and "unzips" to expose single strands of nucleotides on a gene that is then used as a template to assemble the protein. The structures of nucleotides allow the information to be copied because they form hydrogen bonds with only their complementary base pairs The model shows that a strand of mRNA is transcribed from the DNA template strand and that it carries the complementary code from the gene. At the ribosome, tRNA assembles the protein by adding amino acids in the specific order coded for in the mRNA strand. The tRNA molecule carries a 3-base anticodon on one side and an amino acid that is specific to the anticodon on the other side. The model can be used to show how this structure allows the correct amino acid to be placed in the correct order by binding to the complementary bases (the codon) on the mRNA molecule.

Part B: The path from DNA to the swarming response in an individual bee is actually a combination of biological systems because many systems are involved. First, DNA is copied to allow for protein synthesis at the level of the cellular system, which includes the nucleus and ribosomes, to allow for pheromone detection. Detection of pheromones triggers a swarming response that involves the flight and navigation systems of the bee. Flight requires coordination in the wings, and involves cells and tissues working together in muscles to pull on the wing structure for motion. Navigation requires the bee's brain obtaining directional information from the environment and signaling the flight system to move in a specific direction based on the information.

Science Resources

Instructional:

- Tools: A number of documents have been released regarding the Louisiana Student Standards for Science.
  - Shifts in Science
  - Appendix A: Progressions of Learning
  - Appendix B: Connections to ELA and Math Standards
  - Middle School Sample Transition Plan
  - Sample Scope and Sequence Documents
- Professional Development:
  - LDOE will offer sessions at the February Collaboration.
  - LDOE recorded webinars aligned to the LSSS.
  - LA Tech and LSU have conducted summer workshops and will work with districts to do additional training.

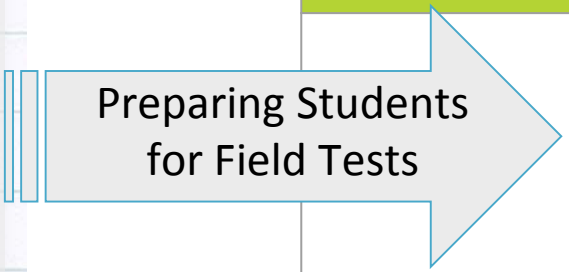
Assessment:

- Science Field Test Guides
- Biology Assessment Guide
- Online Tools Training Available Winter 2017-2018

Brainstorm Supports

Take **5-7 minutes** to brainstorm immediate and long-term supports needed to prepare students for success on the science field tests.

Please plan to share out a few ideas.



Immediate Supports	Long-Term Supports

Next Steps

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- Access the assessment and instructional resources listed in the presentation.
- Use the supports ideas you've generated to
  - communicate the vision for the new LSS for Science and how the new assessments support that vision,
  - promote the shifts in classroom instruction necessary for student mastery of the new Louisiana Student Standards for Science, and
  - communicate the field test design, including item types and set-based design, to prepare teachers and students.

Email assessment@la.gov if you have additional questions.