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New LEAP 2025 Science Grades 3-8 & Biology Assessments Overview
Objectives and Agenda

Objectives:

1. Teachers will learn about and be able to communicate key features of the new LEAP 2025 science assessments.

2. Teachers will apply knowledge of the shifts in science instruction to identify those same shifts in new science assessment items.

Agenda:

1. Vision and Purpose
2. Science Instructional Shifts
3. Science Test Design
4. Sample Test Items and Resources
5. Next Steps
Louisiana’s Approach

Louisiana believes access to the highest quality education allows all students, no matter their zip code, the opportunity for success.

The assessments school systems and teachers use must be connected to standards-aligned curriculum and professional development.

In this session, we will focus on the shifts in science instruction and how the assessments support high quality classroom instruction.
Science Instructional Shifts
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.*
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.

<table>
<thead>
<tr>
<th>Science Idea (not a phenomenon)</th>
<th>Scientific Phenomenon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Forces</td>
<td>Magnets hung at different heights attract different numbers of tacks.</td>
</tr>
<tr>
<td>Weather/Climate</td>
<td>The Arizona monsoon is a large-scale seasonal weather system caused by shifting winds and rainfall patterns.</td>
</tr>
<tr>
<td>Environmental Changes</td>
<td>Some types of snails disappear from their ecosystems when black carp are introduced.</td>
</tr>
</tbody>
</table>
Science Shifts

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

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

Connect Ideas Across Disciplines listed in the Crosscutting Concept (CCC)
### Science Shifts

#### In the classroom, students

**Investigate, Evaluate, and Reason Scientifically (SEP)**
- do more than learn about science concepts
- model and apply the practices of scientists and engineers
- investigate real-world phenomena and solve design problems

**Apply Content Knowledge (DCI)**
- develop skills and content knowledge
- investigate and apply content knowledge to scientific phenomena

**Connect Ideas Across Disciplines (CCC)**
- 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 test, students

**Investigate, Evaluate, and Reason Scientifically (SEP)**
- do more than answer recall questions about science
- apply the practices of scientists and engineers
- investigate each real-world phenomenon and design solutions to given problems

**Apply Content Knowledge (DCI)**
- answer questions that require skills and content knowledge
- use stimulus materials connected to a scientific phenomenon

**Connect Ideas Across Disciplines (CCC)**
- 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
Examples for Discussion

Spoonbills are birds that live near the water along the Louisiana coast. They are white to light pink and often have bright-pink feathers on their wings. While taking a field trip, a few students notice that the feathers of the spoonbills at the zoo are not as bright pink as the feathers of spoonbills in the wild.

The table shows some information about spoonbills in zoos and in the wild.

<table>
<thead>
<tr>
<th>Spoonbills</th>
<th>Diet</th>
<th>Life Span</th>
<th>Habitat</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoo</td>
<td>duck pellets, insects</td>
<td>15 years</td>
<td>fresh water and salt water</td>
<td>eat and sleep in the sun during the day</td>
</tr>
<tr>
<td>Wild</td>
<td>small shrimp, insects</td>
<td>10 years</td>
<td>fresh water and salt water</td>
<td>search for food day and night</td>
</tr>
</tbody>
</table>

Which statement explains the most likely reason why the spoonbills in the zoo have a paler pink color than those in the wild?
A. Spoonbills in the zoo live very close to fresh water.
B. Spoonbills in the zoo sit in the sun for much of the day.
C. Spoonbills in the zoo are older than spoonbills in the wild.
D. Spoonbills in the zoo have a different diet than spoonbills in the wild.*
Examples for Discussion

Annotation: The item requires the student to apply the science practice of **constructing explanations** by **using evidence to support an explanation** and knowledge that **the environment affects the traits that an organism expresses** to demonstrate an understanding of **cause and effect relationships**.

**PE: 3-LS3-2** Use evidence to support the explanation that traits can be influenced by the environment.

- **SEP:** 6. Constructing explanations and designing solutions
- **DCI:** UE.LS3B.b: The environment also affects the traits that an organism expresses.
- **CCC:** Cause and effect relationships are routinely identified, tested, and used to explain change.
PE: 7-MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

**Investigate, Evaluate, and Reason (SEP):** 4. Analyzing and interpreting data

**Apply Content Knowledge (DCI):** MS.PS1B.a Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.

**Connect Ideas Across Disciplines (CCC):** Macroscopic patterns are related to the nature of microscopic and atomic-level structure.

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**Examples for Discussion**

**Use the information and your knowledge of science to answer the question.**

Students at a bonfire noticed that a large amount of gas and ash were produced as they watched the logs of wood burn.

Which statement **best** explains the type of change that occurred as the logs of wood burned?

- **A.** A physical change occurred because the ash and gas produced can easily be turned back into wood.

- **B.** A chemical change occurred because the atoms in the wood reacted with oxygen and rearranged to form new combinations of atoms and molecules.

- **C.** A physical change occurred because the atoms in the wood changed from a solid state to a gaseous state as the atoms in the wood burned.

- **D.** A chemical change occurred because a chemical reaction occurs any time heat is added to a substance.
Examples for Discussion

Annotation: The item requires the student to apply knowledge that substances react chemically in characteristic ways to demonstrate an understanding of patterns.

PE: 7-MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

× SEP: 4. Analyzing and interpreting data

✓ DCI: MS.PS1B.a Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.

✓ CCC: Macroscopic patterns are related to the nature of microscopic and atomic-level structure.
PE: HS-LS3-1 Formulate, refine, and evaluate questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Investigate, Evaluate, and Reason (SEP): 1. Asking questions (science) and defining problems (engineering)

Apply Content Knowledge (DCI): HS.LS3A.b In Mendel’s model of inheritance an organism’s phenotype is determined by the combined expression of two inherited versions they have for each gene. However, most traits follow more complex patterns of inheritance such as traits that are codominant, incomplete dominant, and polygenic.

Connect Ideas Across Disciplines (CCC): Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Examples for Discussion

Use the information and your knowledge of science to answer the question.

During an investigation, two German shepherds with long hair were each bred with a German shepherd with short hair in a first-generation cross. The offspring from each first-generation cross were then bred to produce a second-generation cross.

Which questions could be answered using the results of this investigation?

Select the three correct answers.

- A. Is hair length in German shepherds a dominant or recessive trait?
- B. How often does the mutation for long hair randomly occur in German shepherds?
- C. How does the protein made by the gene for hair length differ among German shepherds?
- D. Is long hair in German shepherds an inherited trait?
- E. What percentage of offspring in the second generation of German shepherds are homozygous for the recessive hair-length trait?
Examples for Discussion

Annotation: The item requires the student to apply the science practice of **asking questions** and to apply knowledge that **an organism’s phenotype is determined by the combined expression of two inherited versions they have for each gene**.

**HS-LS3-1** Formulate, refine, and evaluate questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

- **SEP**: 1. Asking questions (science) and defining problems (engineering)
- **DCI**: HS.LS3A.b In Mendel’s model of inheritance an organism’s phenotype is determined by the combined expression of two inherited versions they have for each gene. However, most traits follow more complex patterns of inheritance such as traits that are codominant, incomplete dominant, and polygenic.
- **CCC**: Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
**Multi-Dimensional Alignment**

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

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Multi-Dimensional Alignment:

**DCI**—What content knowledge does the student need to apply?

**SEP**—How will the student investigate, evaluate, and/or reason scientifically?

**CCC**—What ideas will the student connect across disciplines?

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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.
New LEAP 2025 Science Tests
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.
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
Item Types: Selected Response

- **Selected Response (SR)**: 1 point each

  - **Multiple Choice (MC)**: 4 answer options, 1 correct answer
  - **Multiple Select (MS)**: 5 options (gr. 3 & 4), 5-6 options (gr. 5), 5-7 options (gr. 6-8 & Bio.), more than 1 correct answer, question identifies number of correct answers*
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).

- **Highlight Text**: allows a student to select text-based answer(s) from within a larger text.
Item Types: Two-Part Items

Two-Part Dependent (TPD)
- Part A Correct (2 points)
- Part B Incorrect (1 point)
- Part A Incorrect
  - Cannot Get Point for Part B

Two-Part Independent (TPI)
- Part A Correct (2 points)
- Part B Incorrect (1 point)
- Part A Incorrect
  - Part B Incorrect (0 points)

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Item Types: Constructed Response and Extended Response

**CR**
- short
- 2 pts
- 2-D or 3-D alignment

**ER**
- in-depth
- 6 pts (gr. 3-4)
- 9 pts (gr. 5-8 and Biology)
- 3-D alignment
2018 – 2019 Operational Test

- Tests for all grades/courses will consist of three sessions.
- Test sessions will be timed.

<table>
<thead>
<tr>
<th>Grade/Course</th>
<th># of points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 3</td>
<td>57 points</td>
</tr>
<tr>
<td>Grade 4</td>
<td>61 points</td>
</tr>
<tr>
<td>Grade 5-8 and Biology</td>
<td>67 points</td>
</tr>
</tbody>
</table>
Sample Items
Multi-Dimensional Alignment

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.

4-PS4-2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
Animals have several senses that allow them to survive. The senses of predators and prey are different.

Dogs and other predators have eyes facing forward. They can see a large area with both of their eyes at the same time. This helps them see things far away. This also helps them see things to the right and left without turning their heads. Many predators have good night vision.
Rabbits and other prey animals have eyes on the sides of their heads. They can see a larger area than most predators. However, the area that they can see with both eyes is small. This means that rabbit vision is not very clear. Rabbits also cannot see well at night.

Figure 2 shows the field of vision for a rabbit.
Rabbits cannot see clearly enough to identify the animals they see. Rabbits rely on their senses of smell and hearing to identify what is in their environment. Rabbits have many more smell receptors than humans. These smell receptors allow rabbits to notice and identify predators from a distance. Table 1 compares the number of smell receptors in humans and other animals.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Number of Smell Receptors (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humans</td>
<td>6</td>
</tr>
<tr>
<td>Rabbits</td>
<td>100</td>
</tr>
<tr>
<td>Most dogs</td>
<td>1,000</td>
</tr>
<tr>
<td>Bloodhound dogs</td>
<td>4,000</td>
</tr>
</tbody>
</table>
Which statement **best** explains why a dog’s brain can process more information about smell than a rabbit’s brain can?

A. Dogs take in different kinds of information with their smell receptors than rabbits do.

B. Dogs process information from their noses and tongues to learn about their surroundings.

C. Dogs have a smaller range of vision than rabbits do and learn to rely on their memories about smells.

D. Dogs take in more information because they have at least 10 times as many smell receptors as rabbits have.*

Which science and engineering practice (SEP) is the student demonstrating when answering this question?
Light that reflects off an object will go into the eyes of dogs and rabbits differently, as shown in this figure.

Which statements best explain why the dog is able to see the object more clearly than the rabbit can? Select the two correct answers.

A. The image of the object is visible from both of the dog’s eyes.*
B. The image of the object is visible from both of the rabbit’s eyes.
C. The image of the object is visible from only one of the dog’s eyes.
D. The image of the object is visible from only one of the rabbit’s eyes.*
E. The image of the object is visible from both of the dog’s eyes but neither of the rabbit’s eyes.

What content knowledge (DCI) does the student need to answer this question?
Part A
Which statement best describes how a rabbit processes information that is taken in by the rabbit’s eyes?

A. A rabbit’s eyes send images to its brain so that the rabbit can see a place to hide.
B. A rabbit’s eyes send signals to its muscles so that the rabbit can run from danger.
C. A rabbit’s eyes send signals to its brain so that the rabbit can decide how to respond.*
D. A rabbit’s eyes send images to its ears and nose so that the rabbit can take in more information.

Part B
Which statement best describes how a rabbit knows whether it is in danger?

A. The rabbit’s eyes recognize the shape of a predator.
B. The rabbit’s brain compares memories to information from the environment.*
C. The rabbit’s ears and nose remember what a predator sounds and smells like.
D. The rabbit’s brain combines visual, scent, and sound information into a complete image.
Some dog breeds hunt rabbits by sight. The rabbits see the dogs before the dogs get close to them. When the rabbits realize there is danger, they start running. The dogs chase after the moving rabbits.

Explain why dogs are able to hunt by sight. In your response, be sure to explain:
• why the rabbits see the dogs before the dogs get close to the rabbits
• why the dogs can easily see and follow the moving rabbits

Student’s response correctly explains why the rabbits see the dogs before the dogs see the rabbits AND explains why the dogs can easily see and follow the moving rabbits.

Sample Response:
Rabbits are able to see in all directions because their eyes are on the sides of their heads. Dogs cannot see in all directions but are able to follow the rabbits because their eyes are on the front of their heads, which lets them see clearly in front of them.
Task Set: Zebra Mussels

Multi-Dimensional Alignment

7-MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

7-MS-LS2-5 Undertake a design project that assists in maintaining diversity and ecosystem services.

<table>
<thead>
<tr>
<th>Item #</th>
<th>PE</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MS-LS2-5</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>MS-LS2-4</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>MS-LS2-5</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>MS-LS2-4</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>MS-LS2-5</td>
<td>9</td>
</tr>
</tbody>
</table>
Zebra mussels are small shellfish that are normally found in Eastern Europe. This species was first observed in the Great Lakes area of North America in the 1980s, likely as a result of the zebra mussels attaching to the sides of ships. Zebra mussels reproduce very rapidly in their five-year lifespan. A single zebra mussel can produce five million eggs, with 100,000 of those eggs potentially reaching adulthood. Their main diet is algae and plankton, which can have a large impact on other organisms in the food web. Figure 1 shows the relative sizes of zebra mussels compared to a small coin.
Zebra mussels can spread into new bodies of water by attaching to the sides of ships. They can then spread throughout nearby waterways once they start reproducing. This makes zebra mussels extremely difficult to remove from an ecosystem once they are introduced. One example of a waterway system where this has happened is in the Great Lakes. Graph 1 shows the growth of zebra mussels in different bodies of water in Michigan, Wisconsin, and Minnesota between 1990 and 2005. Many of these bodies of water throughout the three states are connected to the Great Lakes where zebra mussels were first observed.
Figure 2 shows the impact that zebra mussels have on the flow of energy and matter in Lake Michigan. In ecosystems without zebra mussels, most of the energy flows from algae and plankton to fish. Once zebra mussels spread to an ecosystem, most of the energy then flows from algae and plankton directly to the zebra mussels. The figure also shows what percentage of the total ecosystem’s mass each organism group makes up.
Lake Tahoe is one of the largest freshwater lakes in the United States. A new program recently started in the Lake Tahoe area that is being used to monitor for zebra mussels. The water in Lake Tahoe must be kept as clean as possible to help when inspecting the water for the presence of zebra mussels. The efforts at Lake Tahoe have shown that aggressive management strategies can help prevent the spread of these types of species.
Task Set: Zebra Mussels

Part A
Drag the descriptions into the correct order to show how zebra mussels can affect a waterway.

- waterway vegetation increases
- zebra mussels eat algae and plankton
- water becomes clearer to see through
- sunlight reaches bottom of waterway

Part B
Which statement describes the most effective way to monitor waterways to prevent the effects of zebra mussels described in Part A?

A. Take samples of the surface water to look for zebra mussel waste products.
B. Measure algae and plankton levels at the bottom of the waterway.
C. Measure how clear the water is to detect changing algae and plankton levels.*
D. Perform random visual inspections of the bottom of the waterway to look for zebra mussels.
Based on Figure 2, which statement **best** explains a negative impact that zebra mussels can have on an ecosystem?

A. A growing number of zebra mussels can increase the amount of algae and plankton in the water.

B. A growing number of zebra mussels can decrease the water temperature.

C. A growing number of zebra mussels can increase the number of decomposers at the bottom of a waterway.

D. A growing number of zebra mussels can decrease the number of fish living in the water.*
In 2007, mussels similar to zebra mussels were found in waterways near Lake Mead along the Colorado River.

Select the location showing where an inspection checkpoint would be most effective in preventing the further spread of these mussels.
Part A

Which conclusion about the spread of zebra mussels in different waterways is **most supported** by the evidence in Graph 1?

A. Zebra mussels spread into other waterways only after many years of first being introduced into an ecosystem.

B. Waterways in Minnesota are less protected from zebra mussel growth than waterways in Michigan and Wisconsin.

C. Zebra mussels rapidly spread into other waterways once they are first introduced into an ecosystem.

D. Zebra mussel growth eventually becomes constant after long periods of time.

Part B

Which statement from the stimulus best explains the answer to Part A?

A. “This species was first observed in the Great Lakes area of North America in the 1980s, likely as a result of zebra mussels attaching to the sides of ships.”

B. “A single zebra mussel can produce five million eggs, with 100,000 of those eggs potentially reaching adulthood.”

C. “Their main diet is algae and plankton, which can have a large impact on other organisms in the food web.”

D. “The efforts at Lake Tahoe have shown that aggressive management strategies can help prevent the spread of these types of species.”
Part A

Describe one way scientists near Lake Tahoe can detect if the lake has been impacted by zebra mussels.

Part B

Identify and explain one potential issue with the monitoring approach used in areas like Lake Tahoe.

Part C

Identify one possible solution to the issue identified in Part B and explain how the solution would address the issue.
Resources

Assessment:

What’s Available
• Online Tools Training
• Grades 3-8 Field Test Assessment Guides

What’s Coming
• Grades 3-8 Assessment Guides (July 2018)
• Biology Assessment Guide (July 2018)
• Biology Practice Test (Fall 2018)
• Science Practice Test Guidance (Fall 2018)
• 3-8 Practice Tests (January 2019)

Instructional:
• Louisiana Student Standards for Science
• Shifts in Science
• Appendix A: Learning Progressions
• Sample Scope and Sequence Documents
• Louisiana Phenomena Website
Next Steps
Next Steps

- The BEST “test prep” is to teach science according to the instructional shifts.
- Develop plans to transition to phenomenon-based learning.
- Collaborate with other science teachers.
- Facilitate fruitful and frequent science discussions with students.
- Provide regular opportunities for students to express their scientific understanding and reasoning both verbally and written.
Next Steps

The best test prep is classroom instruction designed to integrate and incorporate the new science shifts.

NSTA – Classroom Resources offers numerous grade-appropriate lessons to assist with the new science shifts.

NSTA - Classroom Sample Tasks are also available but are quite lengthy. Modify them to fit your needs.