

2023 Michigan School Testing Conference

Update on M-STEP Science (Clinic E1)

Michigan School Testing Conference

February 16, 2023

John Jaquith

Test Development Manager

Office of Educational Assessment and Accountability

“A Word From Our Sponsor”



MDE Office of Educational Assessment and Accountability, Test Development Unit has two positions open that will be posted shortly (or may be already posted at this point):

*Science Assessment Consultant

* K-12 Large Scale Assessment Consultant

M-STEP Changes/Updates for 2023



Take a Breath!

- **Not much has changed from 2022 for the M-STEP science assessment**
 - **New Report: Topic Bundle Report**
- **This workshop will cover M-STEP Science assessment overview**
- **The standards – a quick “drive-through”**
- **What is a cluster anyway?**
- **Test Blueprint sample**
- **OTTs – not just a test-prep tool**
- **Opportunities for state-level work**
- **Administration and Reporting**

Performance Expectations – Just the Tip of the Iceberg!



Example:

Michigan K-12 PE:

Topic Bundle: Forces and Interactions

Performance Expectation: 3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Performance Expectations – Just the Tip of the Iceberg!



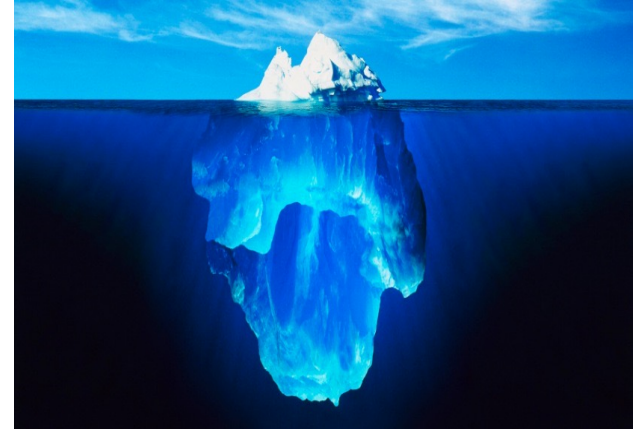
The Michigan K-12 Science Standards can be found here:

[Michigan K-12 Standards Science](#)

- www.Michigan.gov/academicstandards (scroll down to science)
- These are the K-12 Performance Expectations (PE) for science by grade level/band (Grades 1, 2, 3, 4, 5; middle school; high school).
- But there is more!

The PE represent a much richer set of three-dimensional set of content expectations. Please be sure to explore the following resource thoroughly:

<https://www.nextgenscience.org/>



Performance Expectations – Just the Tip of the Iceberg!



Michigan K-12 PE:

Topic Bundle:
Forces and Interactions

Performance Expectation: 3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

<p>Students who demonstrate understanding can:</p> <p>3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. [Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]</p>		
<p>The performance expectation above was developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i>:</p>		
<p style="text-align: center;">Science and Engineering Practices</p> <p>Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.</p> <ul style="list-style-type: none"> Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. <p style="text-align: center;">----- <i>Connections to Nature of Science</i></p> <p>Scientific Investigations Use a Variety of Methods</p> <ul style="list-style-type: none"> Science investigations use a variety of methods, tools, and techniques. 	<p style="text-align: center;">Disciplinary Core Ideas</p> <p>PS2.A: Forces and Motion</p> <ul style="list-style-type: none"> Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) <p>PS2.B: Types of Interactions</p> <ul style="list-style-type: none"> Objects in contact exert forces on each other. 	<p style="text-align: center;">Crosscutting Concepts</p> <p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships are routinely identified.
<p><i>Connections to other DCIs in third grade: N/A</i></p> <p><i>Articulation of DCIs across grade-levels:</i> K.PS2.A ; K.PS2.B ; K.PS3.C ; 5.PS2.B ; MS.PS2.A ; MS.ESS1.B ; MS.ESS2.C</p> <p><i>Common Core State Standards Connections:</i></p> <p><i>ELA/Literacy -</i> RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-PS2-1) W.3.7 Conduct short research projects that build knowledge about a topic. (3-PS2-1) W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-PS2-1)</p> <p><i>Mathematics -</i> MP.2 Reason abstractly and quantitatively. (3-PS2-1) MP.5 Use appropriate tools strategically. (3-PS2-1) 3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. (3-PS2-1)</p>		

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

The section entitled “Disciplinary Core Ideas” is reproduced verbatim from *A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas*. Integrated and reprinted with permission from the National Academy of Sciences.

Three Dimensions



Disciplinary Core Idea

Science and Engineering Practices

Crosscutting Concepts

Students who demonstrate understanding can:

3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. [Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]

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Organization



Domain (Physical Science, Life Science, Earth and Space Science)

Topic Bundle (Forces and Interactions)

Performance Expectation

Three-Dimensional Standard (Use the NGSS site)

PE Bundle – Topic Bundles



- Bundles are one way PEs can be organized to be presented and taught in classrooms.
- Bundled PEs should reflect the structure of the adopted standards.
- Bundled PEs can be assessed via natural phenomena presented within a cluster.

HS. Structure and Function	HS. Space Systems	HS. Structure and Properties of Matter
HS. Inheritance and Variation of Traits	HS. History of Earth	HS. Chemical Reactions
HS. Matter and Energy in Organisms and Ecosystems	HS. Earth's Systems	HS. Forces and Interactions
HS. Interdependent Relationships in Ecosystems	HS. Weather and Climate	HS. Energy
HS. Natural Selection and Evolution	HS. Human Sustainability	HS. Waves and Electromagnetic Radiation

PE Bundles High School



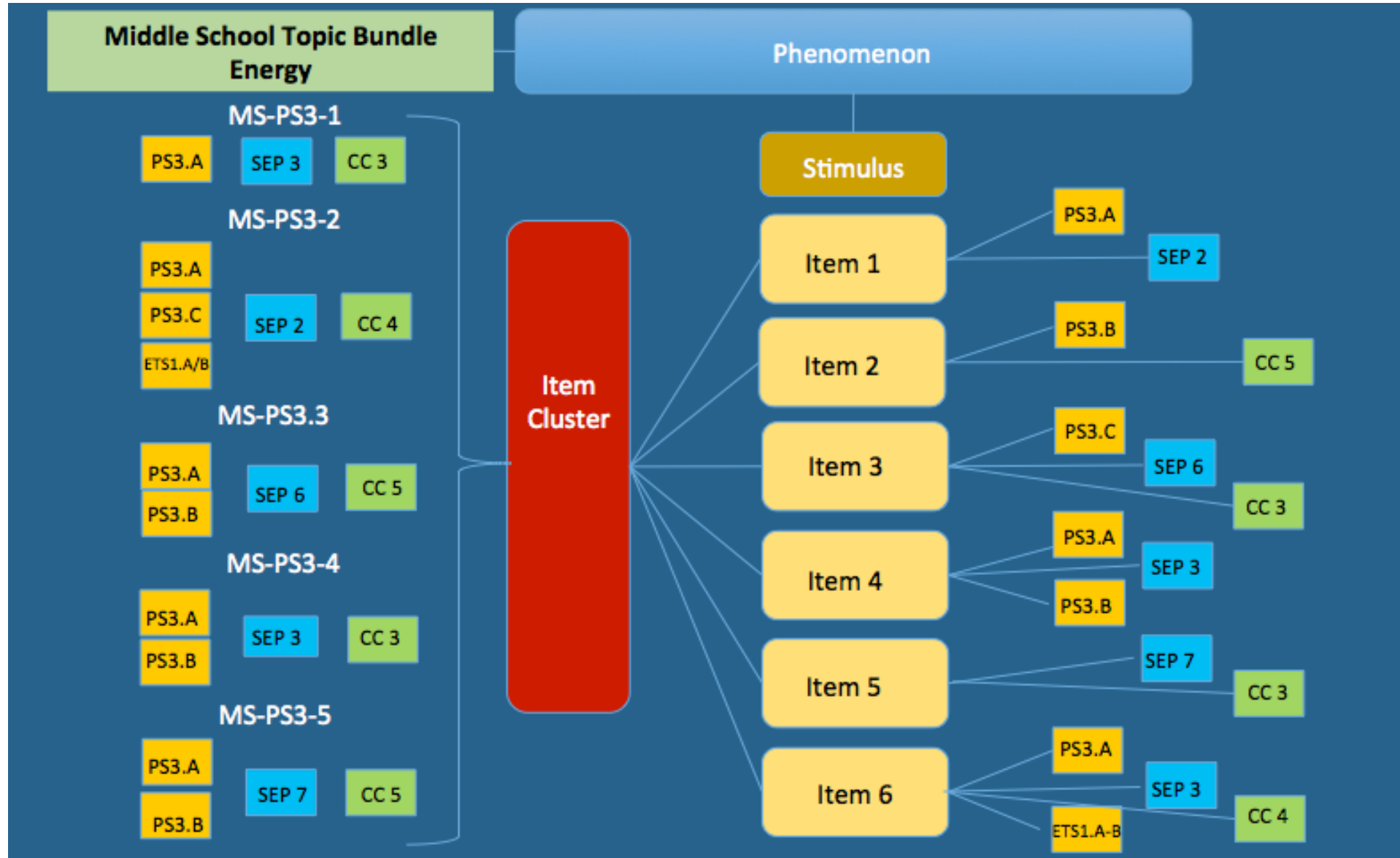
Topic Bundle	Domain
Structure and Function	Life Science
Matter and Energy in Organisms and Ecosystems	Life Science
Interdependent Relationships in Ecosystems	Life Science
Natural Selection and Evolution	Life Science
Inheritance and Variation of Traits	Life Science
Space Systems	Earth and Space Sciences
History of Earth	Earth and Space Sciences
Earth's Systems	Earth and Space Sciences
Weather and Climate	Earth and Space Sciences
Human Sustainability	Earth and Space Sciences

PE Bundles High School -Continued



Topic Bundle	Domain
Structure and Properties of Matter	Physical Science
Chemical Reactions	Physical Science
Forces and Interactions	Physical Science
Energy	Physical Science
Waves and Radiation	Physical Science
Engineering Design*	Engineering*
Total Topic Bundles	16

Example Item Cluster Map



Sample Blueprint



Form 1	Form 2	Form 3	Form 4
Earth Science 2	Earth Science 3	Earth Science 4	Earth Science 5
Life Science 1	Life Science 1	Life Science 1	Life Science 1
Physical Science 2	Physical Science 3	Physical Science 4	Physical Science 5
Field Test	Field Test	Field Test	Field Test
Earth Science 1	Earth Science 1	Earth Science 1	Earth Science 1
Life Science 2	Life Science 3	Life Science 4	Life Science 5
Physical Science 1	Physical Science 1	Physical Science	Physical Science 1

Released Item Clusters



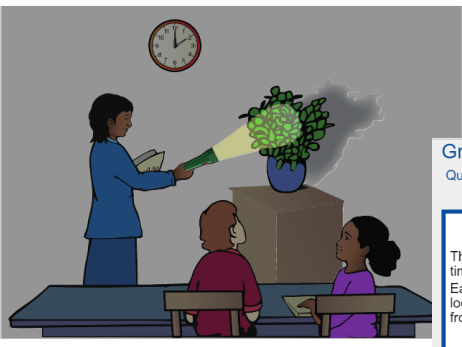
Grade 5 Science Training Student

Question 1

Lights Out! (Part 1)

Students are learning about eyes in science class. During their class discussion, a power outage occurs and the lights go out in the classroom. While the teacher looks for a flashlight, one student exclaims, "I can't see anything!"

The teacher turns on a flashlight and points it across the classroom to a plant on a table. The teacher says, "This makes me wonder how we are able to see the plant."



Which statement **best** describes how the students are able to see the plant?

- (A) Once the plant produces its own light, the students can observe the plant.
- (B) Once the plant absorbs all the light from the flashlight, the students can observe the plant.
- (C) The light from the flashlight is reflected toward the students' eyes and then back to the plant.
- (D) The light from the flashlight is reflected off of the plant and then enters the students' eyes.

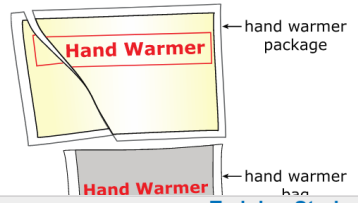
Review/End Test Pause Flag

Grade 8 Science Training Student

Question 1

How do Hand Warmers Work? (Part 1)

Two students are outside in the cold, waiting for a bus. One of the students has a package of hand warmers and offers to share them with the other student. The student opens the package and they each put a hand warmer bag in one of their gloves.



This question has two parts.

Part A: Use the data table to complete the following statement. The students can tell that a chemical reaction involving iron _____ because a new substance _____ form overnight.

Part B: Choose one set of properties that **best** supports the completed statement in Part A.

- (A) density and color
- (B) color and volume
- (C) volume and texture
- (D) texture and mass
- (E) mass and density

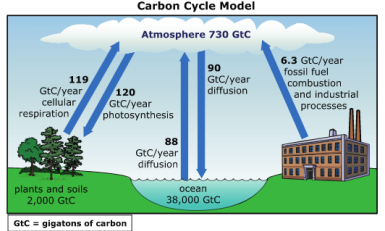
Next

Grade 11 Science Training Student

Question 1

Atmospheric Changes over Time (Part 1)

The gases that make up Earth's atmosphere have changed over time. Scientists measure the levels of carbon dioxide (CO₂) in Earth's atmosphere. The simplified Carbon Cycle Model shows locations where carbon is stored and processes that move carbon from one location to another.



Scientists can use carbon cycle models to help make predictions about the amounts of carbon in different locations. Use this Carbon Cycle Model to identify **all** the processes that would decrease CO₂ in the atmosphere if the rate of that process were to increase.

- (A) photosynthesis
- (B) cellular respiration
- (C) fossil fuel combustion
- (D) diffusion into the ocean
- (E) diffusion into the atmosphere

Review/End Test Pause Flag

Item Cluster Annotations



https://www.michigan.gov/documents/mde/2018_M-STEP_Annotated_Sample_Items_test_614886_7.pdf

M-STEP – Spring 2018

Grade 5 Sample Items

Grade 5 Sample Item Cluster: Lights Out!, Metadata Table

Phenomenon: Human's ability to see in varying levels of light								
Stimulus or Item Part	Brief Description	Item Type	DCI	SEP	CCC	Points	Estimated Time (min)	Hand or Automated Scoring
Stimulus Part 1	The lights go out in a classroom	n/a	n/a	n/a	n/a	n/a	1	n/a
1	Explain ability to see	Multiple Choice	PS4.B	n/a	2	1	1	A
2	Explain how eyes process light	Multiple Choice	LS1.D	n/a	2	1	1	A
3	Complete path of light model	Drag and Drop	PS4.B & LS1.D	2	4	1	2	A
Stimulus Part 2	Eyes as specialized structures	n/a	n/a	n/a	n/a	n/a	3	n/a
4a & 4b	Predict change based on data & Explain prediction based on data	Multiple Select & Multiple Choice	LS1.A	7	2	1	2	A
5	Explain effect of light on pupils	Drag and Drop	LS1.A	7	2	1	3	A
Total			3/3	2/2	2/2	5	13	

The DCI, SEP, and CCC totals refer to the number of the dimensions assessed in the item cluster compared to the number presented in the topic bundle.

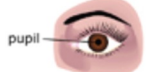
Grade 5 Sample Item Cluster: Lights Out!

Grade 5 Science Training Student

Question 4 ?

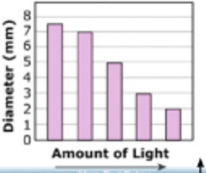
Lights Out! (Part 2)

Human eyes have specialized structures to help people see. One of these structures is the pupil. The pupil is the dark center opening in the middle of the eye.



The size of a pupil can be measured by its diameter. A scientist shines different amounts of light on a pupil and measures the diameter of the pupil. The graph shows the data collected by the scientist.

Effect of Light on Pupil



This question has two parts.

Part A: After a while, the lights come back on in the classroom. How will the students' pupils most likely change?

a The students' pupil diameters will increase.

b The students' pupil diameters will decrease.

Part B: Which statement **best** explains the change in pupil diameter described in Part A?

a Pupil diameter increases when there is low light.

b Pupil diameter increases when there is bright light.

c Pupil diameter decreases when there is low light.

d Pupil diameter decreases when there is bright light.

Review/End Test Pause Flag Back Next

Both parts of the question must be answered correctly for the student to receive 1 point.

The stimulus on the left side of the screen changes to introduce new information regarding the phenomenon. The student can go back to previous stimuli at any time.

Part	Key	Scoring
A	b	*
B	d	1

Assessment Claim: The student chooses a claim portion of an argument regarding effect of light on a pupil and supports the argument using the data given.

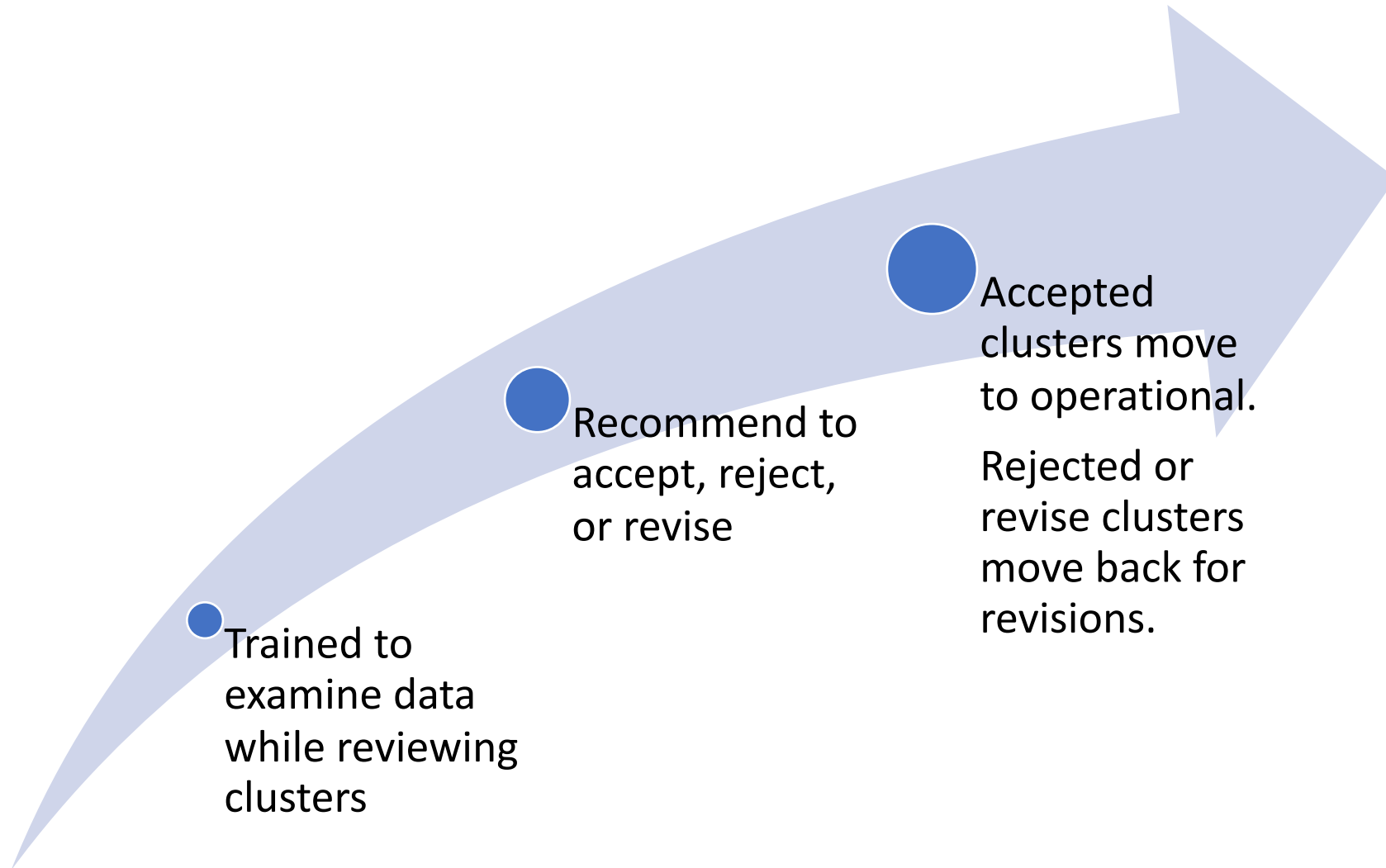
Reflect and Discuss



How might the OTTs and the annotations be helpful:

- For planning instruction and assessment as a teacher
- For use with my students

Content & Equity Item and Data Review Committees



Opportunities for State-Lead Work



Committee	Date
Science Content Review	May 23-24, 2023
Science Bias/ Sensitivity Item Review	May 25, 2023
Item Cluster Development	July 17-21, 2023
Content Data Review	August 8-9, 2023
Bias/Sensitivity Data Review	August 10, 2023

Test Administration



- **One test ticket and one part in grades 5, 8, and 11 for students testing online**
- **One part to be completed in one day for students testing with paper/pencil in grades 5, 8, and 11**
- **CALCULATORS!**
 - **Students may use a calculator for either the online or paper version of the M-STEP Science assessment**
 - **Embedded Online Calculator**
 - **Grade 5 – basic four-function calculator**
 - **Grades 8 and 11 – scientific calculator**
 - **Online Desmos calculator is the same one used for M-STEP Mathematics**

Reporting



New This year!!

Topic Bundle Report

In addition to reporting out on performance (building level) at the Domain level, a Topic Bundle Report will also be provided for the topic bundles assessed.

Data on the Topic Bundle Report will be aggregated and reported at the following levels:

- * State**
- * District**
- * School**

Mock-up of Topic Bundle Report



Science Topic Bundle Analysis Report

Year: 2022 | Assessment: M-STEP | ISD Code: | ISD Name: | District Code: | District Name:

Grade 3 | English Language Arts | All Students

Relative Strength Neither Strength nor Weakness Relative Weakness Insufficient Data to Report

Note: This report compares topic bundle performance to overall test performance within the district. The report identifies relative areas of strength and weaknesses among the identified aggregate group; it is not a proficiency report.

Number of Students Assessed	429
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▼ Domain: Physical Science	
▼ Topic Bundle: Engineering Design	
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	

Sample Only

Questions



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