MASSACHUSETTS
Department of Elementary
and Secondary Education

Release of Spring 2025 MCAS Test Items

from the

Grade 8 Science and Technology/Engineering Paper-Based Test

July 2025
Massachusetts Department of Elementary and Secondary Education

MASSACHUSETTS
Department of Elementary
and Secondary Education

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Overview of Grade 8 Science and Technology/Engineering Test

The spring 2025 grade 8 Science and Technology/Engineering (STE) test was administered in two formats: a computer-based version and a paper-based version. Most students took the computer-based test. The paper-based test was offered as an accommodation for eligible students who were unable to use a computer. More information can be found on the MCAS Test Administration Resources page at www.doe.mass.edu/mcas/admin.html.

Most of the operational items on the grade 8 STE test were the same, regardless of whether a student took the computer-based version or the paper-based version. In places where a technology-enhanced item was used on the computer-based test, an adapted version of the item was created for use on the paper test. These adapted paper items were multiple-choice or multiple-select items that tested the same STE content and assessed the same standard as the technology-enhanced item.

This document displays released items from the paper-based test. Released items from the computer-based test are available on the MCAS Resource Center website at mcas.onlinehelp.cognia.org/released-items.

Test Sessions and Content Overview

The grade 8 STE test was made up of two separate test sessions. Each session included selected-response questions and constructed-response questions. On the paper-based test, the selected-response questions were multiple-choice items and multiple-select items, in which students select the correct answer(s) from among several answer options.

Standards and Reporting Categories

The grade 8 STE test was based on learning standards in the four major content strands in the 2016 *Massachusetts Science and Technology/Engineering Curriculum Framework*. The Framework is available on the Department website at www.doe.mass.edu/frameworks/current.html. The four content strands are listed below.

- Earth and Space Science
- Life Science
- Physical Science
- Technology/Engineering

Science and Technology/Engineering test results are reported under four MCAS reporting categories, which are identical to the four framework content strands listed above.

Most items on the grade 8 STE test are also reported as aligning to one of three MCAS Science and Engineering Practice Categories. The three practice categories are listed below.

- Practice Category A: Investigations and Questioning
- Practice Category B: Mathematics and Data
- Practice Category C: Evidence, Reasoning, and Modeling

More information about the practice categories is available on the Department website at www.doe.mass.edu/mcas/tdd/practice-categories.html.

The tables at the conclusion of this document provide the following information about each operational item: reporting category, standard covered, science and engineering practice category covered (if any), item type, and item description. The correct answers for released selected-response questions are also displayed in the released item table.

Reference Materials

Each student taking the grade 8 STE test was provided with a ruler and a calculator.

During both STE test sessions, the use of authorized bilingual word-to-word dictionaries and glossaries was allowed for students who are currently or were ever reported as English learners. No other reference tools or materials were allowed.

Grade 8
Science and Technology/Engineering
SESSION 1

This session contains 13 questions.

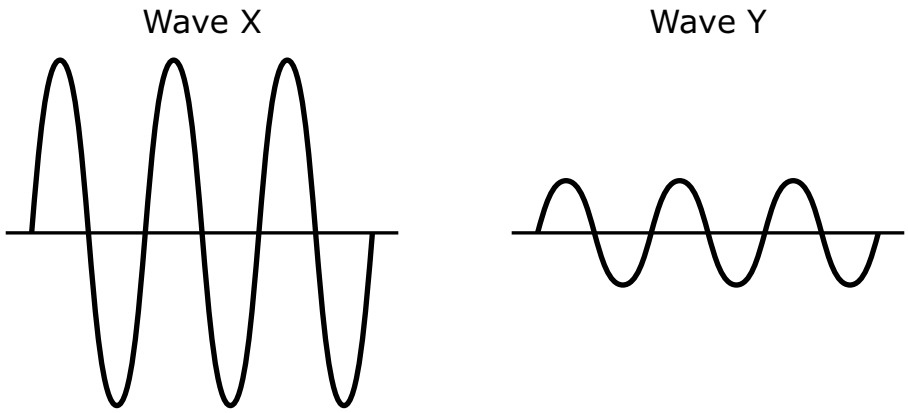
Directions

Read each question carefully and then answer it as well as you can. You must record all answers in this Test & Answer Booklet.

For some questions, you will mark your answers by filling in the circles in your Test & Answer Booklet. Make sure you darken the circles completely. Do not make any marks outside of the circles. If you need to change an answer, be sure to erase your first answer completely.

If a question asks you to show or explain your work, you must do so to receive full credit. Write your response in the space provided. Only responses written within the provided space will be scored.

1 Two waves, X and Y, are shown in the diagram.



Which of the following best compares the energy of wave X with the energy of wave Y?

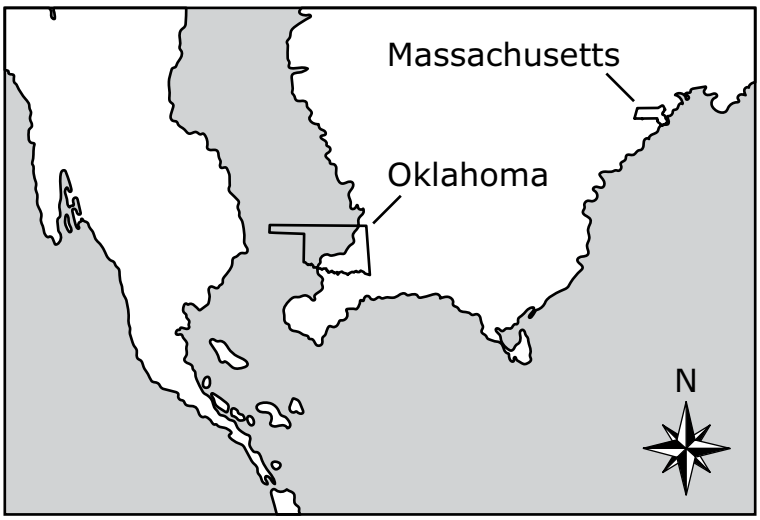
Ⓐ Wave X has more energy than wave Y because wave X has a larger amplitude.

Ⓑ Wave X has less energy than wave Y because wave X has a smaller wavelength.

Ⓒ Wave X has the same amount of energy as wave Y because waves X and Y have the same amplitude.

Ⓓ Wave X has the same amount of energy as wave Y because waves X and Y have the same wavelength.

2 The map shows part of the land masses from 90 million years ago that became North America. The areas that became Oklahoma and Massachusetts are outlined on the map.



Which of the following best explains why Oklahoma has more oil and natural gas than Massachusetts today?

Ⓐ Part of Massachusetts was once covered by plant life, but Oklahoma was not.

Ⓑ Part of Massachusetts was once covered by large rocks, but Oklahoma was not.

Ⓒ Part of Oklahoma was once covered by fresh water, but Massachusetts was not.

Ⓓ Part of Oklahoma was once covered by shallow oceans, but Massachusetts was not.

3 Some students compared different designs for a set of stairs that would allow a small dog to climb onto a sofa or bed. Each design was 100 cm tall. Some characteristics of each design are shown in the table.

Design	Material	Mass of Stairs (kg)	Mass Stairs Can Hold (kg)	Number of Steps
1	cardboard	1	15	2
2	wood	4	30	3
3	wood and cardboard	3	25	5
4	wood and metal	5	50	4

The students determined that design 3 was best. Which of the following criteria was the **most** important for evaluating the stair designs?

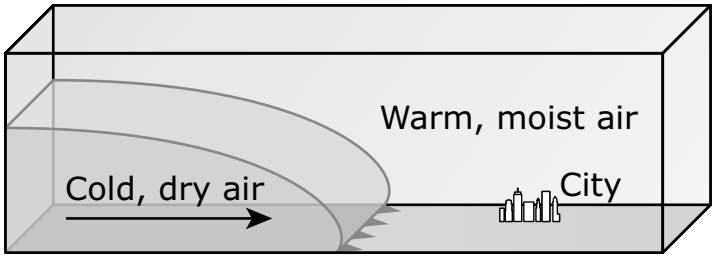
Ⓐ being as lightweight as possible

Ⓑ holding as much mass as possible

Ⓒ being made of the strongest materials

Ⓓ having the shortest height between steps

4 The diagram shows the movement of a cold, dry air mass toward a warm, moist air mass near a city.



Which of the following describes what will happen as the air masses interact?

Ⓐ The air in the city will become cooler, and the skies above the city will become clear.

Ⓑ The air in the city will become cooler, and the skies above the city will become cloudy.

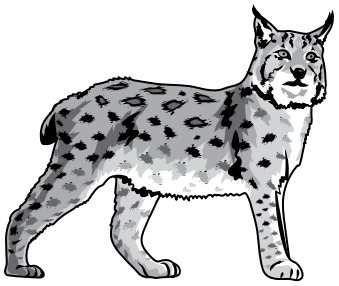
Ⓒ The air in the city will become warmer, and the skies above the city will become clear.

Ⓓ The air in the city will become warmer, and the skies above the city will become cloudy.

The following section focuses on the Canada lynx and its habitat.

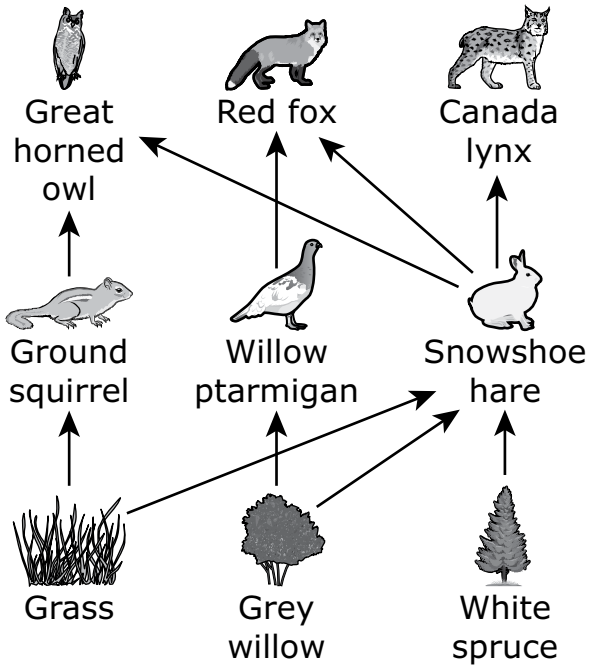
Read the information below and use it to answer the three selected-response questions and one constructed-response question that follow.

A Canada lynx is a mid-sized cat that lives mostly in the cold, snowy forests of Alaska and Canada. Its hind legs are longer than its front legs, making it a fast runner. The Canada lynx covers large areas to find prey at night and uses its excellent eyesight to spot prey. A picture of a Canada lynx is shown.



Canada lynx live and hunt alone, except for mothers raising their young. Mothers care for their young in dens inside hollow logs or under fallen trees and stay with them for about a year.

The Canada lynx is part of a Canadian forest ecosystem. Part of a food web for the ecosystem is shown.



5 The food web shows different ecological relationships.

Which of the following describes the Canada lynx's relationship with the red fox?

Ⓐ competetive

Ⓑ mutually beneficial

Ⓒ parasitic

Ⓓ predatory

Which of the following describes the red fox's relationship with the snowshoe hare?

Ⓐ competetive

Ⓑ mutually beneficial

Ⓒ parasitic

Ⓓ predatory

6 Based on the food web, which of the following tables best shows the ecological roles of the Canada lynx, the white spruce, and the snowshoe hare?

Ⓐ

Organism	Role
Canada lynx	primary consumer
white spruce	producer
snowshoe hare	secondary consumer

Ⓑ

Organism	Role
Canada lynx	secondary consumer
white spruce	producer
snowshoe hare	primary consumer

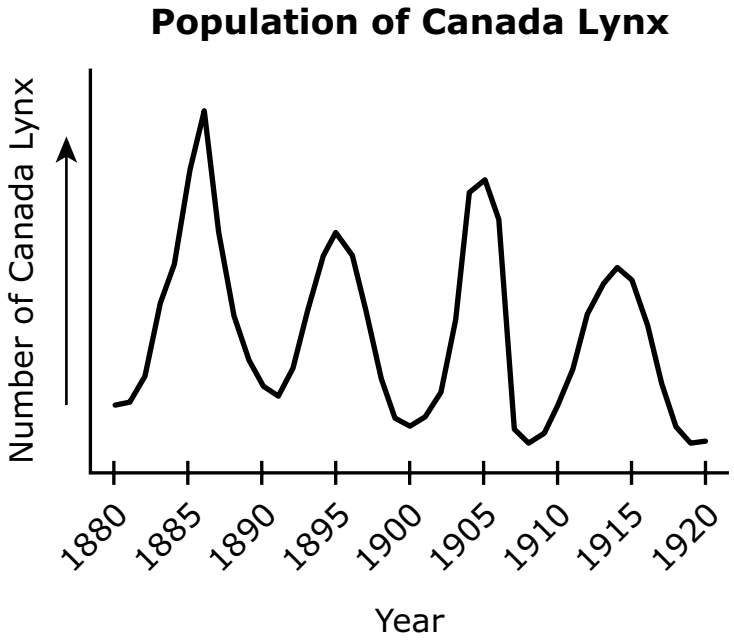
Ⓒ

Organism	Role
Canada lynx	producer
white spruce	secondary consumer
snowshoe hare	primary consumer

Ⓓ

Organism	Role
Canada lynx	primary consumer
white spruce	secondary consumer
snowshoe hare	producer

7 The graph shows changes in a population of Canada lynx in northwest Canada from 1880 to 1920.



The Canada lynx population peaks about every

Ⓐ 2 years.

Ⓑ 5 years.

Ⓒ 10 years.

Ⓓ 20 years.

These peaks are most likely caused by

Ⓐ a decrease in grassy fields.

Ⓑ an increase in snowshoe hares.

Ⓒ an increase in great horned owls.

Ⓓ a decrease in Canada lynx births.

This question has two parts. Write your response on the next page. Be sure to label each part of your response.

8 Snowshoe hares change fur color depending on the season. In winter, their fur is mostly white, while in spring and summer their fur is mostly brown. The pictures show how the snowshoe hare blends into its environment in winter and in summer.

Winter

D. Gordon E. Robertson/ Wikimedia

Summer

National Park Service

A. Explain how blending into its environment most likely helps the snowshoe hare survive.

B. The timing of a snowshoe hare's color change is influenced by genetics. Some individual snowshoe hares change their fur color from white to brown earlier in the spring than other snowshoe hares. Because of climate change, the areas where snowshoe hares live are expected to have fewer days with snow on the ground in the spring.

Describe how the number of snowshoe hares that change fur color earlier in the spring is expected to change. Explain your reasoning using your knowledge of natural selection.

8

This question has two parts.

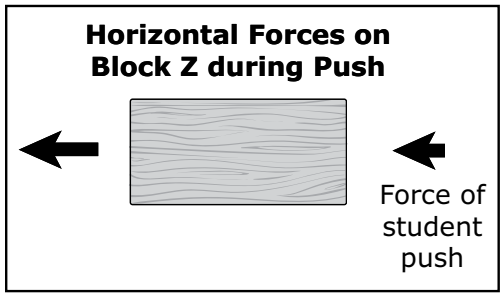
9 A student completed an investigation with three identical wooden blocks. Weights were added on top of each block to give the blocks different masses. The student pushed each block with the same amount of force for the same amount of time. The table shows data from the investigation.

Block	Total Mass (kg)	Speed before Push (m/s)	Speed after Push (m/s)
X	0.6	0	2.8
Y	1.2	0	0.7
Z	1.8	0	0

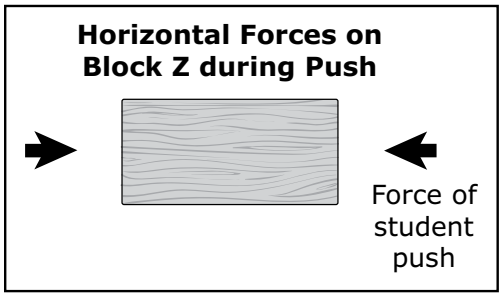
Part A

Which of the following models shows the horizontal forces acting on block Z as it is pushed?

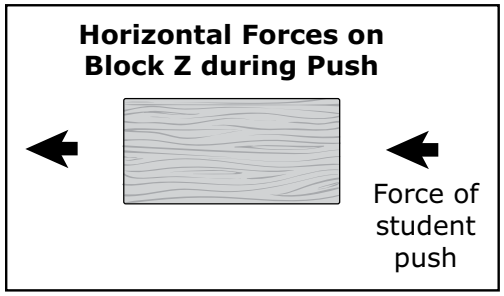
Ⓐ



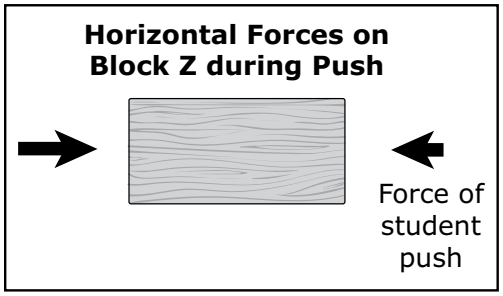
Ⓑ



Ⓒ



Ⓓ



Part B

The student pushed blocks X and Y with the same amount of force.

Explain why block X had a greater speed than block Y after both blocks were pushed.

9

This question has two parts.

10 The same roller coaster track is shown in diagram 1 and diagram 2. In diagram 1, cart W and cart X are shown without riders. In diagram 2, cart Y and cart Z are shown with riders.

Diagram 1

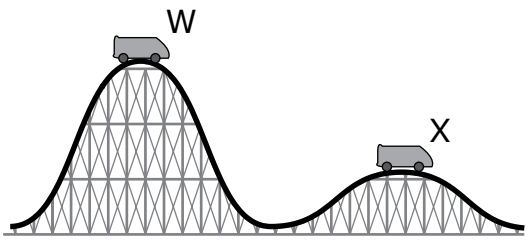
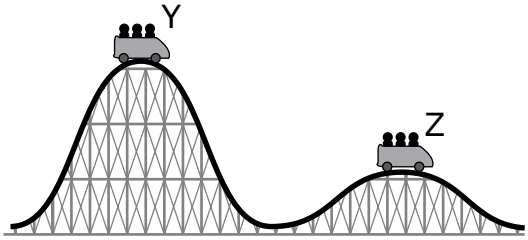


Diagram 2



Part A

Which cart has the most gravitational potential energy?

Ⓐ cart W

Ⓑ cart X

Ⓒ cart Y

Ⓓ cart Z

Part B

Which of the following best compares the gravitational potential energy of cart X and cart Z?

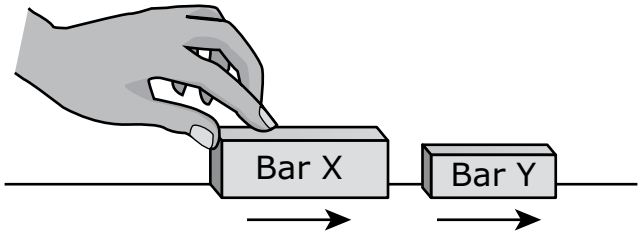
Ⓐ Cart X has less gravitational potential energy than cart Z because cart X has a smaller mass than cart Z.

Ⓑ Cart X has more gravitational potential energy than cart Z because cart X has a greater speed than cart Z.

Ⓒ Cart X has the same gravitational potential energy as cart Z because cart X is at the same height as cart Z.

Ⓓ Cart X has the same gravitational potential energy as cart Z because cart X is made of the same material as cart Z.

11 A student places two bars, bar X and bar Y, on a table. The student slides bar X toward bar Y. This causes bar Y to move in the same direction as bar X, but the bars do not touch. The setup is shown.



Why does bar Y move in the same direction as bar X?

Ⓐ The air pressure from bar X pulls bar Y.

Ⓑ The force of gravity from bar X pushes bar Y.

Ⓒ The electric fields around bar X and bar Y attract each other.

Ⓓ The magnetic fields around bar X and bar Y repel each other.

12 Night blindness is a condition that makes it difficult for a person to see in very low light. Night blindness is controlled by a gene that has a dominant form (**B**) and a recessive form (**b**). People with this condition have only the recessive form of the gene.

A mother carries both the dominant form and the recessive form of the gene. The father has night blindness caused by this gene.

Which Punnett square can be used to determine the probability that a child of the two parents will have night blindness?

Ⓐ

	B	**b**
b	**Bb**	**bb**
b	**Bb**	**bb**

Ⓑ

	B	**b**
B	**BB**	**Bb**
B	**BB**	**Bb**

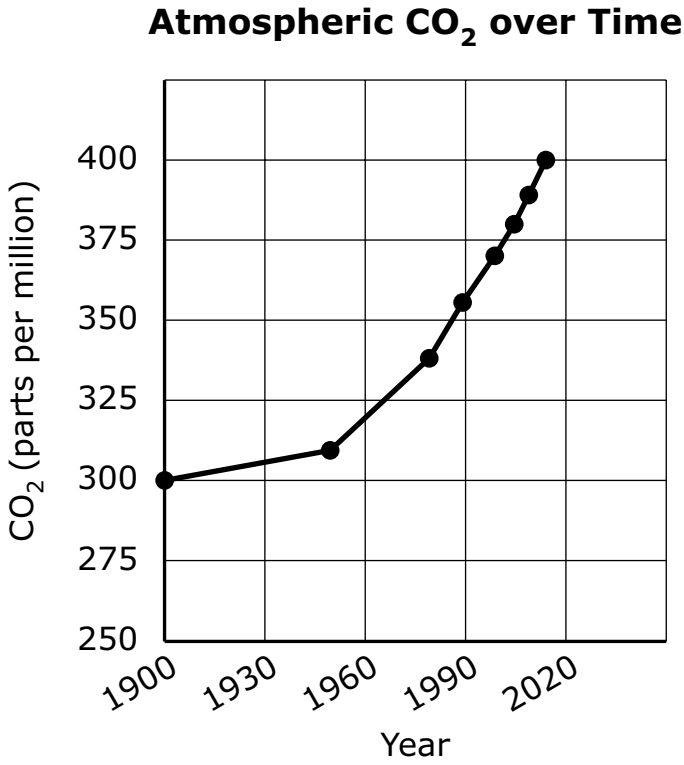
Ⓒ

	B	**B**
b	**Bb**	**Bb**
b	**Bb**	**Bb**

Ⓓ

	B	**b**
B	**BB**	**Bb**
b	**Bb**	**bb**

13 The graph shows the amount of carbon dioxide (CO_2) in Earth's atmosphere over time.



Select **three** activities that have contributed to the change in CO_2 levels in the atmosphere.

Ⓐ using bicycles as a form of transportation

Ⓑ cutting down forests to build farms and cities

Ⓒ burning coal at power plants to make electricity

Ⓓ using solar panels to collect energy from the Sun

Ⓔ using fossil fuels to power vehicles such as trucks and cars

Grade 8
Science and Technology/Engineering
SESSION 2

This session contains 7 questions.

Directions

Read each question carefully and then answer it as well as you can. You must record all answers in this Test & Answer Booklet.

For some questions, you will mark your answers by filling in the circles in your Test & Answer Booklet. Make sure you darken the circles completely. Do not make any marks outside of the circles. If you need to change an answer, be sure to erase your first answer completely.

If a question asks you to show or explain your work, you must do so to receive full credit. Write your response in the space provided. Only responses written within the provided space will be scored.

14 Cell phones use radio wave signals to transfer information to and from cell towers. The quality of cell phone service in an area depends on the ability of a cell phone to detect signals, which depends on the cell phone's distance from a cell tower. The table shows whether cell phones at different distances from a cell tower can detect a signal.

Distance from Cell Tower (km)	Signal Detected
10	yes
20	yes
30	yes
40	sometimes
50	sometimes
60	no

A town wants to improve the quality of cell phone service in its neighborhoods by increasing the number of cell towers in the town. The town will pay for each cell tower added and wants to limit costs.

Based on the information, at which distance should new cell towers be added so that all neighborhoods can detect a signal?

Ⓐ less than 10 km

Ⓑ less than 30 km

Ⓒ between 40 and 50 km

Ⓓ between 50 and 60 km

This question has two parts.

15 The diagram shows some phases of the Moon.

Part A

Which statement **best** describes what causes the Moon to have phases?

Ⓐ Light from Earth is reflected by both the Sun and the Moon, creating a rotating pattern.

Ⓑ The Moon produces a constant amount of light, but its rotation changes the amount of light that reaches Earth.

Ⓒ Earth casts a shadow on the Moon, and the positions of the Sun, Earth, and the Moon change in relationship to each other over time.

Ⓓ Light from the Sun is reflected by the Moon, and the positions of the Sun, Earth, and the Moon change in relationship to each other over time.

Part B

What occurs during **one** cycle of the Moon's phases?

Ⓐ Earth revolves halfway around the Sun.

Ⓑ The Moon completes one orbit around Earth.

Ⓒ The side of the Moon that faces Earth changes.

Ⓓ Earth and the Moon complete one orbit around the Sun.

16 A student wants to create a model of the Milky Way galaxy. Which of the following should the student include in the model?

Ⓐ a flashlight, to represent the Sun as the center of the Milky Way

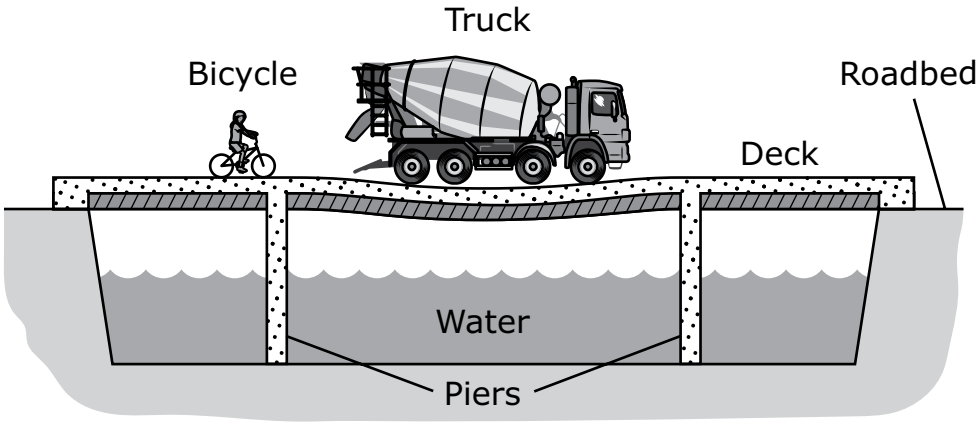
Ⓑ eight stickers, arranged to represent all the planets in the Milky Way

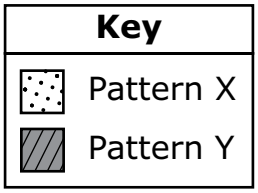
Ⓒ a box, to represent the boundaries of the universe and the Milky Way

Ⓓ sand particles, spread out to represent the billions of stars in the Milky Way

This question has three parts. Write your response on the next page. Be sure to label each part of your response.

17 Two patterns, X and Y, are used to show where compression and tension forces are acting on a bridge, as shown in the diagram.





A. Identify **two** live loads on the bridge that are shown in the diagram.

B. Identify the pattern in the diagram that shows where compression forces are acting on the bridge. Describe how compression is acting on the bridge.

C. Identify the pattern in the diagram that shows where tension forces are acting on the bridge. Describe how tension is acting on the bridge.

17

18 A company manufactures outdoor benches made of wood. Which action represents a finishing step in the manufacturing process of a wood bench?

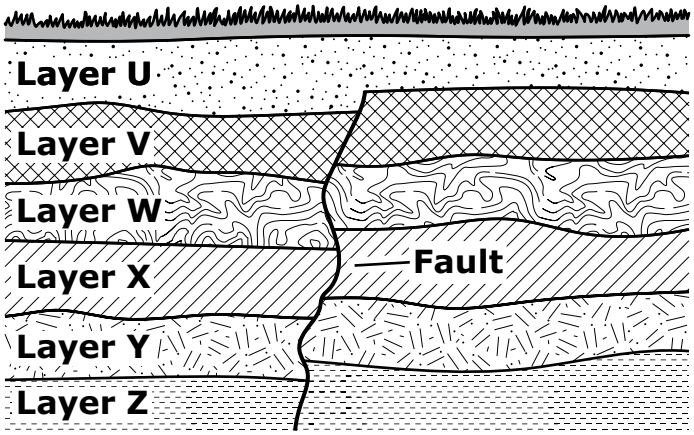
Ⓐ sawing the wood

Ⓑ drilling holes in the wood

Ⓒ testing the strength of the wood

Ⓓ applying waterproof paint to the wood

19 A large fault in several rock layers is shown in the diagram.



Which rock layer is the youngest rock layer that was present when the fault formed?

Ⓐ layer U

Ⓑ layer V

Ⓒ layer W

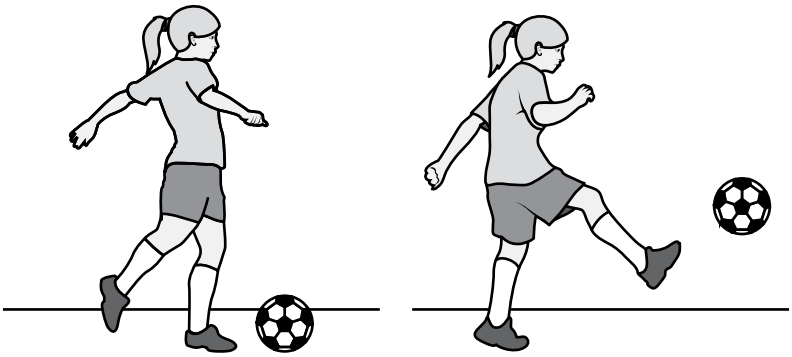
Ⓓ layer X

Ⓔ layer Y

Ⓕ layer Z

20 An athlete kicks a soccer ball. The diagram represents the soccer ball in two positions, X and Y.

In position X, the ball is at rest on the ground, just before being kicked. In position Y, the ball is in the air, just after being kicked.



Position X Position Y

Which of the following best describes the energy of the ball?

Ⓐ The ball gains kinetic energy from the kick.

Ⓑ The ball loses gravitational potential energy from the kick.

Ⓒ The ball has more kinetic energy in position X than in position Y.

Ⓓ The ball has more gravitational potential energy in position X than in position Y.

Grade 8 Science and Technology/Engineering
Spring 2025 Released Operational Items

PBT Item No.	Page No.	Reporting Category	Standard	Science and Engineering Practice Category	Item Type*	Item Description	Correct Answer**
1	3	*Physical Science*	6.PS.4.1	C. Evidence, Reasoning, and Modeling	SR	Interpret models of waves to compare their energies.	A
2	4	*Earth and Space Science*	8.ESS.3.1	C. Evidence, Reasoning, and Modeling	SR	Explain why two locations can have different amounts of fossil fuel resources.	D
3	5	*Technology/ Engineering*	6.ETS.1.1	A. Investigations and Questioning	SR	Analyze data to determine the most important criteria for evaluating a solution to a design problem.	D
4	6	*Earth and Space Science*	8.ESS.2.5	C. Evidence, Reasoning, and Modeling	SR	Interpret a diagram to describe how the weather will change in a location as two air masses interact.	B
5	8	*Life Science*	7.LS.2.2	C. Evidence, Reasoning, and Modeling	SR	Interpret a food web to determine the ecological relationships among organisms in an ecosystem.	A;D
6	9	*Life Science*	7.LS.2.3	C. Evidence, Reasoning, and Modeling	SR	Interpret a food web to identify a producer, a primary consumer, and a secondary consumer in an ecosystem.	B
7	10	*Life Science*	7.LS.2.1	B. Mathematics and Data	SR	Analyze a graph to describe how a population changed over time.	C;B
8	11–12	*Life Science*	8.LS.4.4	C. Evidence, Reasoning, and Modeling	CR	Explain how a certain characteristic helps an animal survive, and explain how a population is expected to change due to natural selection as the environment changes.	
9	13–14	*Physical Science*	8.PS.2.2	B. Mathematics and Data	CR	Analyze data to complete a model showing the strength and direction of forces acting on a block, and explain how two blocks can have different speeds when pushed with the same amount of force.	
10	15	*Physical Science*	7.PS.3.2	C. Evidence, Reasoning, and Modeling	SR	Analyze a diagram to identify which object has the greatest gravitational potential energy (GPE), and explain why the GPE of one object is different than the GPE of a second object.	C;A
11	16	*Physical Science*	7.PS.2.5	C. Evidence, Reasoning, and Modeling	SR	Explain why one object moves when another object is moved closer to it.	D
12	16	*Life Science*	8.LS.3.4	C. Evidence, Reasoning, and Modeling	SR	Analyze Punnett squares to identify which one can be used to determine the probability of a trait for a given cross.	A
13	17	*Earth and Space Science*	8.ESS.3.5	B. Mathematics and Data	SR	Use a graph to determine changes in carbon dioxide levels in the atmosphere and identify several activities that have contributed to these changes.	B,C,E
14	19	*Technology/ Engineering*	7.ETS.1.4	B. Mathematics and Data	SR	Interpret data to describe how to improve a communication system.	B
15	20	*Earth and Space Science*	6.ESS.1.1	None	SR	Determine the cause of the Moon's phases, and identify what occurs during one cycle of the Moon's phases.	D;B

PBT Item No.	Page No.	Reporting Category	Standard	Science and Engineering Practice Category	Item Type*	Item Description	Correct Answer**
16	21	*Earth and Space Science*	6.ESS.1.5	C. Evidence, Reasoning, and Modeling	SR	Describe how a student could build a model that would best represent a galaxy.	D
17	22–23	*Technology/ Engineering*	7.ETS.3.4	C. Evidence, Reasoning, and Modeling	CR	Identify live loads, tension forces, and compression forces in a system and describe how those forces act on the system.	
18	24	*Technology/ Engineering*	8.ETS.2.5	None	SR	Determine the finishing step in the manufacturing process of a product.	D
19	24	*Earth and Space Science*	6.ESS.1.4	C. Evidence, Reasoning, and Modeling	SR	Analyze a diagram to determine the youngest rock layer that was present when a fault formed.	B
20	25	*Physical Science*	7.PS.3.5	C. Evidence, Reasoning, and Modeling	SR	Describe how the kinetic energy of an object changes in a given scenario.	A

* Science and Technology/Engineering item types are: selected-response (SR) and constructed-response (CR).

** Answers are provided here for selected-response items only. Sample responses and scoring guidelines for any constructed-response items will be posted to the Department's website later this year.

Grade 8 Science and Technology/Engineering
Spring 2025 Unreleased Operational Items

PBT Item No.	Reporting Category	Standard	Science and Engineering Practice Category	Item Type*	Item Description
21	*Life Science*	6.LS.4.2	C. Evidence, Reasoning, and Modeling	SR	Describe evidence that supports a close evolutionary relationship between an extinct species and a living species.
22	*Earth and Space Science*	6.ESS.2.3	C. Evidence, Reasoning, and Modeling	SR	Determine a geologic feature of a model that provides evidence of Earth's plates spreading apart.
23	*Earth and Space Science*	6.ESS.1.4	C. Evidence, Reasoning, and Modeling	SR	Interpret a diagram to identify the relative ages of rock layers.
24	*Physical Science*	6.PS.1.7	C. Evidence, Reasoning, and Modeling	SR	Explain why a tectonic plate sinks below another plate.
25	*Earth and Space Science*	8.ESS.2.1	C. Evidence, Reasoning, and Modeling	CR	Describe a similarity in how two types of geologic features formed and explain how each feature formed.
26	*Physical Science*	7.PS.3.6	C. Evidence, Reasoning, and Modeling	CR	Determine whether radiation, conduction, or convection are occurring in different parts of a model and explain the reasoning.
27	*Technology/ Engineering*	7.ETS.1.2	C. Evidence, Reasoning, and Modeling	SR	Evaluate a decision matrix to determine which design best meets the criteria.
28	*Earth and Space Science*	8.ESS.1.2	B. Mathematics and Data	SR	Determine the data needed to calculate the gravitational force between two objects.
29	*Earth and Space Science*	8.ESS.2.6	C. Evidence, Reasoning, and Modeling	SR	Interpret a map to explain temperature differences between two cities.
30	*Life Science*	8.LS.4.5	None	SR	Describe how artificial selection can be used to produce offspring with a desired trait.
31	*Technology/ Engineering*	7.ETS.3.3	C. Evidence, Reasoning, and Modeling	SR	Determine the best solution to improve a transportation system.
32	*Life Science*	6.LS.1.2	C. Evidence, Reasoning, and Modeling	SR	Determine the location on a student's cell model where genes should be added.
33	*Technology/ Engineering*	7.ETS.3.5	None	SR	Determine the output of a communication system.
34	*Physical Science*	6.PS.1.6	A. Investigations and Questioning	SR	Identify the evidence that an exothermic reaction occurred in an investigation.
35	*Life Science*	7.LS.2.4	A. Investigations and Questioning	SR	Analyze a food web to identify what data should be measured to determine how the introduction of a species would impact another organism in the ecosystem.
36	*Life Science*	6.LS.1.3	None	CR	Identify a body system that interacts with the respiratory system and describe how body cells use oxygen.
37	*Physical Science*	6.PS.1.7	C. Evidence, Reasoning, and Modeling	SR	Explain why a certain liquid in a container separates into layers.
38	*Physical Science*	8.PS.1.1	C. Evidence, Reasoning, and Modeling	SR	Compare the properties of two molecules by interpreting models of the molecules.
39	*Technology/ Engineering*	7.ETS.3.2	None	SR	Describe the benefits and drawbacks of using one communication system instead of a different communication system.
40	*Life Science*	8.LS.1.7	None	SR	Identify a similarity among different types of food molecules.
41	*Technology/ Engineering*	6.ETS.2.2	A. Investigations and Questioning	SR	Determine the most important properties for a material that will be used in a design.

* Science and Technology/Engineering item types are: selected-response (SR) and constructed-response (CR).