Grade 6 Science Practice Test Answer Key

This document contains the answer keys, rubrics, and Scoring Notes for items on the Grade 6 Science Practice Test. Additional Practice Test resources are available in the LDOE Practice Test Library.

Session	Set	Sequence	Item Type	Key	Point Value	Alignment
1	Properties of Light and Sound Waves	1	MC	C	1	PE: 6-MS-PS4-2 SEP: 2. Developing and using models DCI: MS.PS4A.b
1		2	TEI	See Rubric	2	PE: 6-MS-PS4-2 SEP: 2. Developing and using models DCI: MS.PS4B.a
1		3	MC	D	1	PE: 6-MS-PS4-1 SEP: 5. Using mathematics and computational thinking DCI: MS.PS4A.a CCC: Patterns
1		4	TPD: MC/ MC	A/C	2	PE: 6-MS-PS4-1 SEP: 5. Using mathematics and computational thinking DCI: MS.PS4A.a CCC: Patterns
1	Organelles	5	MC	B	1	PE: 6-MS-LS1-1 SEP: 3. Planning and carrying out investigations DCI: MS.LS1A.a CCC: Scale, Proportion and Quantity
1		6	TEI	See Rubric	2	PE: 6-MS-LS1-2 SEP: 2. Developing and using models DCI: MS.LS1A.b CCC: Structure and Function
1		7	MS	A, C, E	1	PE: 6-MS-LS1-1 SEP: 3. Planning and carrying out investigations DCI: MS.LS1A.a CCC: Scale, Proportion and Quantity
1		8	CR	See Rubric	2	PE: 6-MS-LS1-2 SEP: 2. Developing and using models DCI: MS.LS1A.b CCC: Structure and Function
1	Asteroids in the Solar System	9	MC	B	1	PE: 6-MS-ESS1-2 SEP: 2. Developing and using models DCI: MS.ESS1B.a CCC: Systems and System Models
1		10	TEI	See Rubric	1	PE: 6-MS-ESS1-3 DCI: MS.ESS1B.a CCC: Scale, Proportion and Quantity
1		11	TPD: MC/ MC	D/C	2	PE: 6-MS-ESS1-3 SEP: 4. Analyzing and interpreting data DCI: MS.ESS1B.a CCC: Scale, Proportion and Quantity

Session	Set	Sequence	Item Type	Key	Point Value	Alignment
1	Asteroids in the Solar System	12	CR	See Rubric	2	PE: 6-MS-ESS1-2 SEP: 2. Developing and using models DCI: MS.ESS1B.a CCC: Systems and System Models
1	Standalone Items	13	MS	A, C	1	PE: 6-MS-LS2-3 SEP: 2. Developing and using models DCI: MS.LS2B.a CCC: Energy and Matter
1		14	TEI	See Rubric	2	PE: 6-MS-PS2-2 SEP: 3. Planning and carrying out investigations DCI: MS.PS2A.b
1		15	TPD: TE/ MC	See Rubric	2	PE: 6-MS-PS1-1 SEP: 2. Developing and using models DCI: MS.PS1.A.a
2	Marbles	16	MC	B	1	PE: 6-MS-PS3-1 SEP: 4. Analyzing and interpreting data DCI: MS.PS3A.a CCC: Scale, Proportion and Quantity
2		17	TEI	See Rubric	2	PE: 6-MS-PS3-1 DCI: MS.PS3A.a CCC: Scale, Proportion and Quantity
2		18	MC	D	1	PE: 6-MS-PS3-2 SEP: 2. Developing and using models DCI: MS.PS3A.b CCC: Systems and System Models
2		19	TPI: MS/ MC	B, D/ B	2	PE: 6-MS-PS3-2 SEP: 2. Developing and using models DCI: MS.PS3C.a CCC: Systems and System Models
2		20	ER	See Rubric	9	PE: 6-MS-PS3-2 SEP: 2. Developing and using models DCI: MS.PS3A.b CCC: Systems and System Models
2	Standalone Items	21	MC	C	1	PE: 6-MS-LS1-2 SEP: 2. Developing and using models DCI: MS.LS1A.b CCC: Structure and Function
2		22	TPI: TE/ MC	See Rubric	2	PE: 6-MS-ESS3-4 SEP: 7. Engaging in argument from evidence DCI: MS.ESS3C.b
2		23	TPI: TE/ MC	See Rubric	2	PE: 6-MS-ESS1-1 SEP: 2. Developing and using models DCI: MS.ESS1A.a CCC: Patterns
3	Changes in Earth's Magnetic Field	24	MC	B	1	PE: 6-MS-PS2-3 DCI: MS.PS2B.a CCC: Cause and Effect

Session	Set	Sequence	Item Type	Key	Point Value	Alignment
3	Changes in Earth's Magnetic Field	25	TEI	See Rubric	2	PE: 6-MS-PS2-3 DCI: MS.PS2B.a CCC: Cause and Effect
3		26	TEI	See Rubric	1	PE: 6-MS-PS2-5 SEP: 3. Planning and carrying out investigations DCI: MS.PS2B.c
3		27	CR	See Rubric	2	PE: 6-MS-PS2-5 SEP: 3. Planning and carrying out investigations DCI: MS.PS2B.c CCC: Cause and Effect
3	Anasazi and the Great Drought	28	MC	C	1	PE: 6-MS-LS2-1 SEP: 4. Analyzing and interpreting data DCI: MS.LS2A.b CCC: Cause and Effect
3		29	MC	C	1	PE: 6-MS-LS2-1 SEP: 4. Analyzing and interpreting data DCI: MS.LS2A.c CCC: Cause and Effect
3		30	TEI	See Rubric	2	PE: 6-MS-LS2-2 SEP: 6. Constructing explanations (for science) and designing solutions (for engineering) DCI: MS.LS2A.d CCC: Patterns
3		31	TPD: MC/ MS	B/ A, D	2	PE: 6-MS-LS2-2 SEP: 6. Constructing explanations (for science) and designing solutions (for engineering) DCI: MS.LS2A.d CCC: Patterns
3	Standalone Items	32	MC	D	1	PE: 6-MS-ESS1-1 SEP: 2. Developing and using models DCI: MS.ESS1B.b
3		33	MC	B	1	PE: 6-MS-PS2-2 DCI: MS.PS2A.b CCC: Stability and Change
3		34	MS	B, D	1	PE: 6-MS-LS1-1 DCI: MS.LS1A.a CCC: Scale, Proportion and Quantity
3		35	TEI	See Rubric	1	PE: 6-MS-PS3-2 SEP: 2. Developing and using models DCI: MS.PS3A.b CCC: Systems and System Models
3		36	MC	C	1	PE: 6-MS-LS2-3 SEP: 2. Developing and using models DCI: MS.LS2B.a

Session	Set	Sequence	Item Type	Key	Point Value	Alignment
3	Standalone Items	37	TEI	See Rubric	2	PE: 6-MS-PS2-5 DCI: MS.PS2B.c CCC: Cause and Effect
3		38	MC	C	1	PE: 6-MS-ESS1-2 DCI: MS.ESS1A.b CCC: Systems and System Models
3		39	MC	C	1	PE: 6-MS-PS2-4 SEP: 7. Engaging in argument from evidence DCI: MS.PS2B.b
3		40	TEI	See Rubric	2	PE: 6-MS-PS2-1 SEP: 6. Constructing explanations (for science) and designing solutions (for engineering) DCI: MS.PS2A.a
3		41	TEI	See Rubric	1	PE: 6-MS-PS4-1 SEP: 5. Using mathematics and computational thinking DCI: MS.PS4A.a CCC: Patterns

Item Types and Scoring:

- Multiple-choice (MC) questions with four answer options and only one correct answer. All MC items are worth one point each.

  Multiple-select (MS) questions with five to seven answer options and more than one correct answer. For MS items, the question identifies the number of correct answers, unless it is part of a Two-part Dependent (TPD). In a TPD, the question in Part B will then be worded to “select all that apply.” All MS items are worth one point each.

- Technology Enhanced Items (TEI): uses technology to capture student comprehension in authentic ways, previously difficult to score by machine for large-scale assessments. TE items are worth up to two points and may include item types such as, but not limited to, drag and drop, dropdown menus, and hot spots.

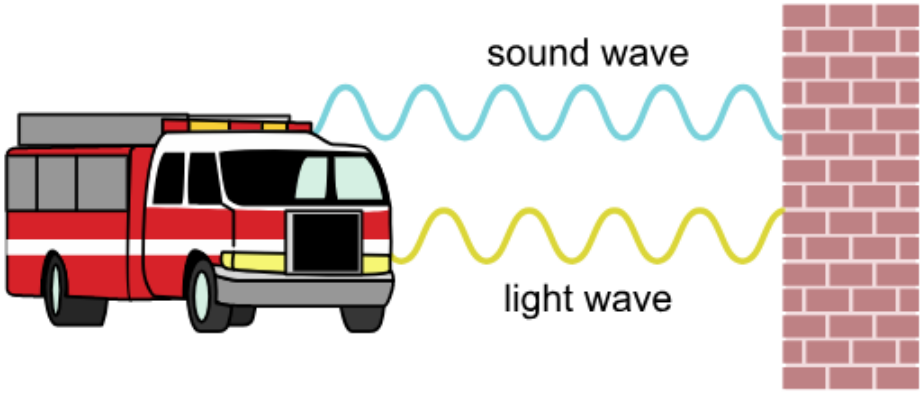
- Two-part Items: require students to answer two related questions, worth a total of two points. Two-part items may combine MC, MS, and/or TE item types.
  - Two-part Dependent (TPD): the first part must be correct in order to earn credit for the second part. TPDs are scored as follows:
    - If both parts are correct, score is 2.
    - If Part A is correct and Part B is incorrect or partially correct, score is 1.
    - If Part A is incorrect, score is 0 regardless of Part B.
  - Two-part Independent (TPI): each part is scored independently, with each part worth one point.

- Constructed Response (CR): requires a brief response provided by the student and will be scored using a 2-point rubric. These items may require a brief paragraph, a few sentences, and/or completion of a chart.

- Extended Response (ER): asks students to write an in-depth response that expresses the students’ ability to apply all three dimensions of the LSS for Science and will be scored using a 9-point rubric.

Session 1 Item 2 (TEI) - Rubric

The diagram shows sound and light waves from an emergency vehicle traveling toward a brick wall. The brick wall has both smooth and rough surfaces.



Select the correct answer from **each** drop-down menu to complete the sentences about how each wave is affected by the brick wall.

The sound waves from the siren will [pass through and reflect off ▾] the smooth surface of the wall. The light waves from the emergency vehicle will [only reflect off ▾] the smooth surface of the wall. Rougher sections of the wall surface will cause the [sound and light waves ▾] from the emergency vehicle to scatter.

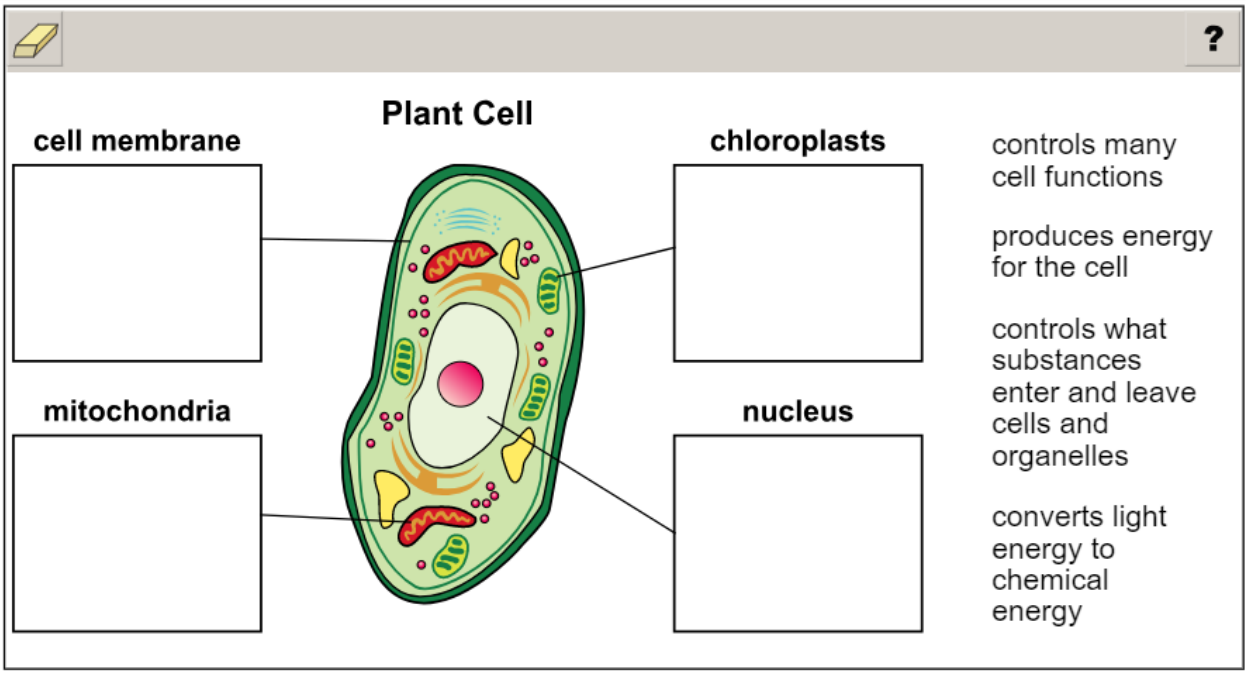
Scoring Notes:

This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 3 correct responses; therefore 1 point will be awarded if the student selects 2 correct responses.

Session 1 Item 6 (TEI)

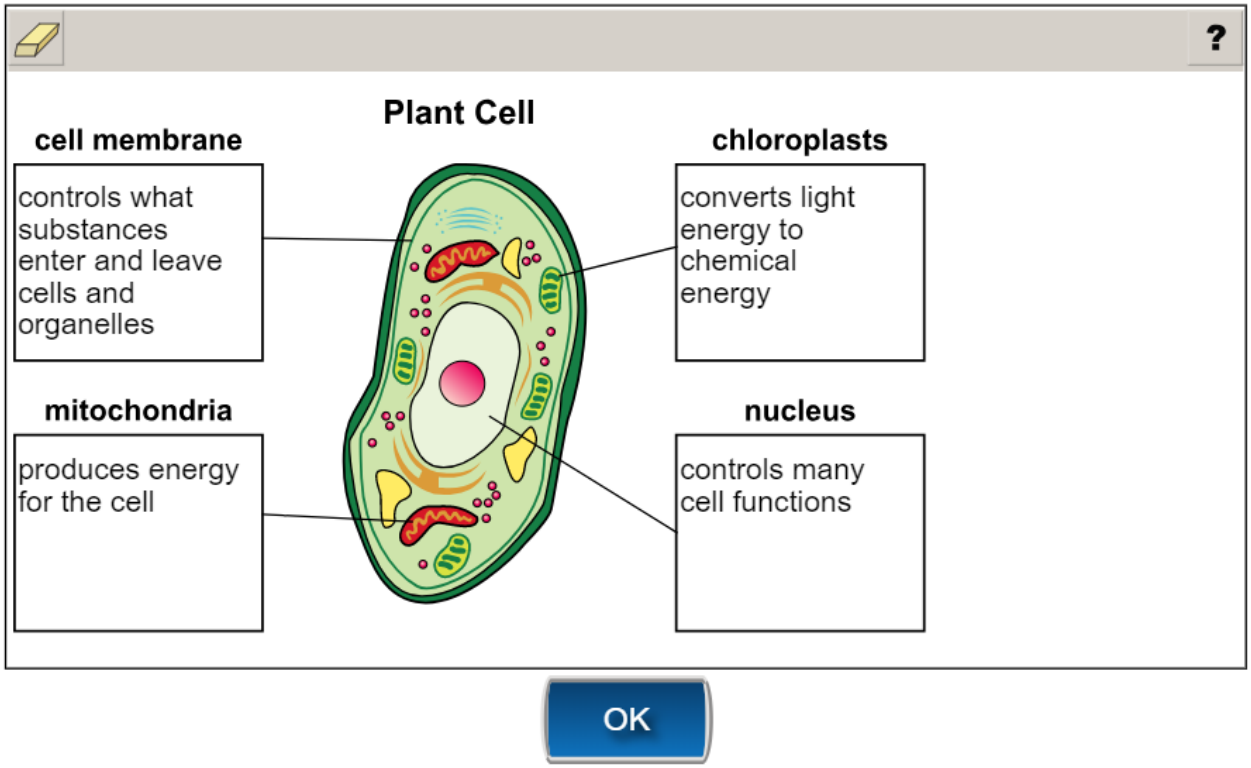
Drag **each** label describing the function of each organelle into the boxes to complete the model of a plant cell.

Each label will be used once.



OK

Session 1 Item 6 (TEI) - Rubric



Scoring Notes:

This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 4 correct responses; therefore 1 point will be awarded if the student selects 2 or more correct responses.

Session 1 Item 8 (CR)

The scientists are designing an experiment to study the small, hairlike organelles on the outsides of some cells found in humans. They want to compare the structures of these organelles to cells from other multicellular organisms, such as plants. These organelles can have features with sizes as small as 50 to 100 nanometers (nm).

Use Figure 2 to describe which type of microscope the scientists should use to study the features of the hairlike organelles. Explain **one** possible function for these organelles based on where the organelles are located in the cell model in Figure 1.

Scoring Information	
Score	**Description**
2	Student's response correctly describes why the scientists should use an electron microscope AND explains at least one possible function for the hairlike organelles on the outside of some human cells.
1	Student's response correctly describes why the scientists should use an electron microscope OR explains at least one possible function for the hairlike organelles on the outside of some human cells.
0	Student's response does **not** correctly describe why the scientists should use an electron microscope or explain at least one possible function for the hairlike organelles on the outside of some human cells. **OR** Student's response is blank, irrelevant, or too brief to evaluate.

Scoring Notes:

- Description of why the features of the organelles being studied are too small to see with a light microscope based on the size range given (1 point)
- Explanation for at least one possible function for the hairlike organelles on the outside of some human or animal cells (1 point)

Examples include:

- An electron microscope should be used because the organelle details are too small for a light microscope, which cannot see details at 50-100 nm. The hairlike organelles could help the cell to move.
- An electron microscope should be used because the organelle features are smaller than the lower limit of a light microscope. The hairlike organelles could help protect the cell from harmful objects.

Accept other reasonable answers.

Session 1 Item 10 (TEI) - Rubric

Based on Figure 1, select the correct answer from **each** drop-down menu to complete the sentence.

As Apollo asteroids approach Earth, the [mass ▾] of Earth can affect the [orbit ▾] of the asteroids.

Session 1 Item 12 (CR)

Scientists must consider many factors when using a spacecraft to change the path of asteroids traveling close to Earth. Using Figure 1, describe how the force of gravity from Earth could affect nearby Apollo asteroids and explain how the effect of Earth's gravity could change the orbital motion of an Apollo asteroid.

Scoring Information	
Score	**Description**
2	Student's response correctly describes how the force of gravity from Earth could affect nearby Apollo asteroids AND correctly explains how the effect of Earth's gravity could change the orbital motion of an Apollo asteroid.
1	Student's response correctly describes how the force of gravity from Earth could affect nearby Apollo asteroids OR correctly explains how the effect of Earth's gravity could change the orbital motion of an Apollo asteroid.
0	Student's response does **not** correctly describe how the force of gravity from Earth could affect nearby Apollo asteroids or correctly explains how the effect of Earth's gravity could change the orbital motion of an Apollo asteroid. **OR** Student's response is blank, irrelevant, or too brief to evaluate.

Scoring Notes:

- Description of how the force of gravity from Earth affects nearby Apollo asteroids (1 point)
- Explanation of how the effect of Earth's gravity can change the orbital motion of nearby Apollo asteroids (1 point)

Examples include:

- Apollo asteroids traveling close to Earth could be pulled closer to Earth by Earth's gravitational force causing the asteroid to now orbit Earth.
- Figure 1 shows that the Apollo asteroids orbit the Sun. If an Apollo asteroid gets too close to Earth, Earth's gravitational force can pull the asteroid into Earth's orbit.

Accept other reasonable answers.

Session 1 Item 14 (TEI)

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

A student is designing an experiment to test how different types of surfaces affect the size of the force needed to move an object. The student will use a spring scale to measure the size of the force needed to drag a brick across different flat surfaces.

Drag the correct label into **each** box in the table to identify the independent variable, dependent variable, and control variable in the experiment.

Not all labels will be used.

Independent Variable	
Dependent Variable	
Control Variable	

mass of brick

surface material

height of flat surface

size of the force needed to move brick

Session 1 Item 14 (TEI) - Rubric

Independent Variable	surface material
Dependent Variable	size of the force needed to move brick
Control Variable	mass of brick

height of flat surface

Scoring Notes:

This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 3 correct responses; therefore 1 point will be awarded if the student selects 2 correct responses.

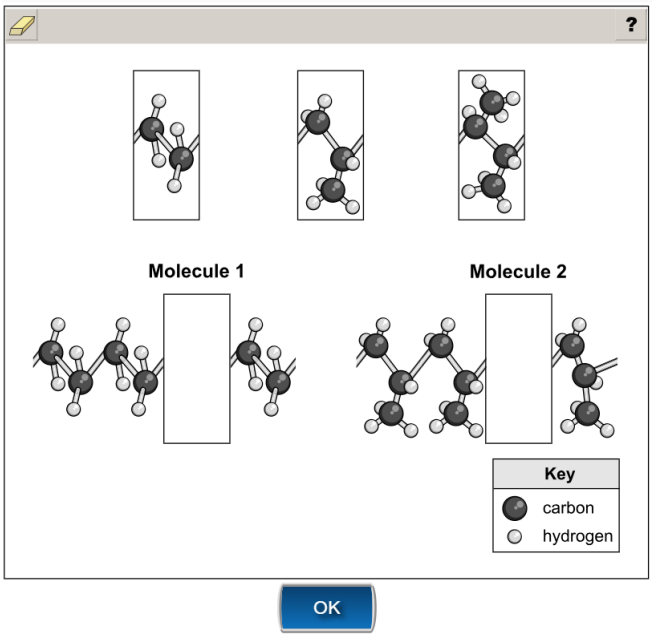
Session 1 Item 15 (TPD)

Use the information and your knowledge of science to answer the questions.
Crude oil, also known as petroleum, is a liquid that is found within the earth. This liquid can be refined to form products such as gasoline, rubber, and different plastics. The oil is made up of different types of hydrocarbon molecules, which often contain repeating units of hydrogen and carbon atoms. The hydrocarbon molecules removed from crude oil can then be used to produce other large molecules.

Part A

Drag the molecule pieces into the correct boxes that **best** complete the partial model of the two molecules formed from hydrocarbon molecules.

Each molecule piece may be used more than once. Not all molecule pieces will be used.



Part B

Which structural feature of the two molecules **best** explains the answer to Part A?

(a) Both molecules should contain carbon and hydrogen atoms.

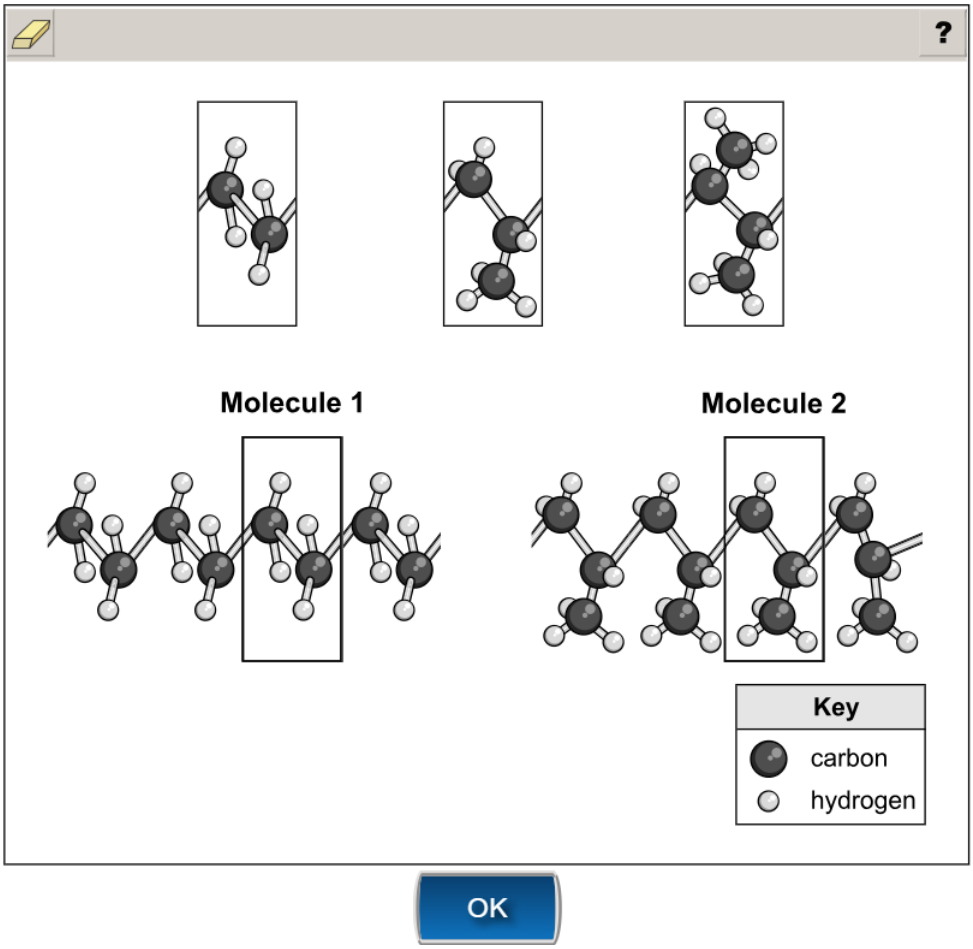
(b) The arrangement of carbon and hydrogen atoms should repeat in a regular pattern.

(c) The hydrogen atoms should be smaller than the carbon atoms.

(d) The number of hydrogen atoms should be greater than the number of carbon atoms.

Session 1 Item 15 (TPD) - Rubric

Part A



OK

Note: In Accommodated form, Answer key will be "Piece 1 in Molecule X" and "Piece 2 in Molecule Y."

Part B

Which structural feature of the two molecules **best** explains the answer to Part A?

(a) Both molecules should contain carbon and hydrogen atoms.

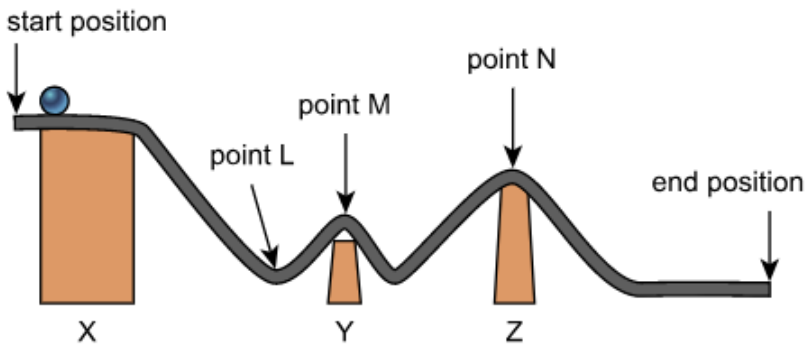
(b) The arrangement of carbon and hydrogen atoms should repeat in a regular pattern.

(c) The hydrogen atoms should be smaller than the carbon atoms.

(d) The number of hydrogen atoms should be greater than the number of carbon atoms.

Session 2 Item 17 (TEI) - Rubric

The students measure the speed of one of the marbles at the three points shown in the figure.



Select the correct answer from **each** drop-down menu to complete the paragraph.

The speed of the marble at point L will be
[faster than ▾] the speed of the marble at point M.
The speed of the marble at point N will be
[slower than ▾] the speed of the marble at point M.
For the three points measured on the track, the marble will have the most kinetic energy at [point L ▾] and the least kinetic energy at [point N ▾].

Scoring Notes:

This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 4 correct responses; therefore 1 point will be awarded if the student selects 2 or more correct responses.

Session 2 Item 20 (ER)

The students want to see how changes to the design of the marble track will affect the speed and energy of the marbles.

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

- Address all the instructions in each prompt.
- Use evidence from the information provided and your own knowledge of science to support your responses.

Part A
One student wants to increase the potential energy of the marble at the starting position. Explain one way the students can adjust the track to increase the marble's potential energy. In your explanation,

- describe the dimensions of any materials used to adjust the track and
- explain why the adjustment to the track would increase the marble's potential energy.

Part B
Another student wants to use another marble that will have a greater kinetic energy than either the ceramic marble or the steel marble at each point along the track. Explain how the mass and size of the third marble should compare to the masses and sizes of the ceramic and steel marbles. Explain the reasoning for your answer.

Part C
One student wants to change the track so that the potential energy of the marble from point 1 to point 5 is constant. Explain how the student could change the track so that that the potential energy of the marble is constant and explain why that change will keep the potential energy constant.

<u>Score Points</u>

- 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.
- The student's score is 0 if the response is blank, incorrect, or does not address the prompt.

Session 2 Item 20 (ER), continued

PART A (0-3 points maximum)

- 1 point for describing change to track design
- 1 point for describing dimensions or relative size of materials used
- 1 point for explaining how change increases the potential energy at the starting position

PART B (0-3 points maximum)

- 1 point for explaining that the mass of the marble should be greater than the mass of the other two balls, but the size should be the same
- 1 point for explaining that kinetic energy increases as mass increases
- 1 point for explaining that keeping the size the same will not cause additional friction that could affect the speed

PART C (0-3 points maximum)

- 1 point for describing that the student should make the track the same height throughout points 1-5.
- 1 point relating potential energy to height
- 1 point for explaining that the potential energy will be the same at all points along the track if the track height is always the same

<u>Score Information</u>

PART A: Student explains that block X should be replaced (1 point) with a higher block (1 point) because potential energy increases with increasing height (1 point).

- Replace block X
- Use a block with a greater height than block X
- Potential energy will increase because of the increase in height for the new block

NOTE: Accept any other plausible explanation of replacing block X with a higher block to increase the potential energy of the marble.

Session 2 Item 20 (ER), continued

Part B: Student explains the mass of the marble should be increased while the size is kept the same (1 point) because the kinetic energy increases with an increase in mass (1 point) but keeping the size the same will not cause additional friction that could affect the speed (1 point).

- Marble mass should be increased; size kept the same
- Kinetic energy increases as mass increases
- Kinetic energy decreases as the speed decreases

NOTE: Accept any other plausible explanation about increasing the mass of the marble to increase the kinetic energy of the marble.

Part C:

Student describes a change to make the track height an equal height all along the track from points 1 to 5 (1 point). Student explains that potential energy depends on height (1 point) and so an equal height throughout the track will keep the potential energy constant (1 point).

- Make the track height an equal height all along the track
- Potential energy depends on height
- An equal height will result in a constant potential energy

NOTE: Accept any other plausible explanation of how to make the track height equal along the track to result in a constant potential energy.

Student Responses for Session 2 Item 20

Part A
One student wants to increase the potential energy of the marble at the starting position. Explain one way the students can adjust the track to increase the marble's potential energy. In your explanation,

- describe the dimensions of any materials used to adjust the track and
- explain why the adjustment to the track would increase the marble's potential energy.

Response 1

To increase the potential energy of the marble at the starting position, you can replace Block X with a block that has more energy, so instead of 45 cm for height, you can do 55 cm for height on Block X. The adjustment to the track would increase the marbles potential energy because the higher an object is, the more gravitational potential energy there is.

Score: 3
This response earns a 3. It fully and accurately describes that Block X should be replaced with a block of greater height and describes dimensions or relative size of the materials used, “you can replace Block X with a block that has more energy, so instead of 45 cm for height, you can do 55 cm for height on Block X.” The response provides an explanation of how this change increases the potential energy, “The adjustment to the track would increase the marbles potential energy because the higher an object is, the more gravitational potential energy there is.”

Response 2

To increase the PE, the student has to add more height because the more height the more PE. The student can do this by adding another wooden block student should add another block X because they are bigger.

Score: 2
This response earns a 2. It accurately describes the relative size of the materials used but does not accurately describe that Block X should be replaced at the starting position, “To increase the PE, the student has to add more height… The student can do this by adding another wooden block student should add another block X because they are bigger.” If the response accurately noted to place Block X at the starting position, the response would receive credit. The response provides an explanation of how this change increases the potential energy, “because the more height the more PE.”

Response 3

To increase the potential energy, you would want to have more hills and steeper ones. The higher up you go the more potential energy there will be. You would want more hills because it would have more higher points. Therefore increasing the amount od potential energy. I would say to add one more 30 cm block and one more 15 cm block in that order. This would make hills that would add more high points. Then I would a just the tubing to lay flatter to the east side of the blocks then curving them out at the bottom to male steeper hills and make the bottoms well equipped to go back up.

Score: 1

This response earns a 1. It does not accurately describe that Block X should be replaced with a block of greater height nor does it describe the dimensions or relative size of the materials used. The response provides an explanation of how the change increases the potential energy, “The higher up you go the more potential energy there will be.”

Response 4

One way that the students can adjust the track to increase the marble’s potential energy is by making the starting position way lower and that would increase the marbles potential energy because it would start off moving slow.

Score: 0

This response earns a 0. It does not describe that Block X should be replaced with a block of greater height nor does it describe the dimensions or relative size of the materials used. The response does not provide an accurate explanation of how the change increases the potential energy.

Part B

Another student wants to use another marble that will have a greater kinetic energy than either the ceramic marble or the steel marble at each point along the track. Explain how the mass and size of the third marble should compare to the masses and sizes of the ceramic and steel marbles. Explain the reasoning for your answer.

Response 1

If another marble were too have more kinetic energy than the ceramic marble or steel marble at each point on the track, the marble would have to have more mass. This is because the more mass an object has, the more kinetic energy it has. This is why you have a marble with more mass in order to have more kinetic energy than the other two marbles. If another marble were too have a different size than the ceramic marble or steel marble at each point on the track, this could affect the speed and change the kinetic energy. This is why the marble needs to stay the same size.

Score: 3

This response earns a 3. It accurately explains that the mass of the marble should be greater than the mass of the other two balls and the size of the marble should be the same, “the marble would have to have more mass. the marble needs to stay the same size.” The response provides an explanation that kinetic energy increases as mass increases, “This is because the more mass an object has, the more kinetic energy it has.” It provides an explanation that keeping the marble the same size will not affect the speed, “If another marble were too have a different size than the ceramic marble or steel marble at each point on the track, this could affect the speed and change the kinetic energy.”

Response 2

In order to increase the kinetic energy the student must increase the mass they can do this by getting heavier or different marbles. But they cannot change the size because if they do than the marbles won’t fit on the track.

Score: 2

This response earns a 2. It accurately explains that the mass of the marble should be greater than the mass of the other two balls and the size of the marble should be the same, “they can do this by getting heavier or different marbles. But they cannot change the size.” The response provides an explanation that kinetic energy increases as mass increases, “In order to increase the kinetic energy the student must increase the mass.” It does not provide an accurate explanation that keeping the marble the same size will not affect the speed, “the marbles won’t fit on the track.”

Response 3

The mass and size of the third marble should compare to the masses and sizes of the ceramic and steel marbles because the marble would have to be the same size, but it could just have a greater mass. I think this because the size doesn't really affect the kinetic energy, but speed and mass does.

Score: 1

This response earns a 1. It accurately explains that the mass of the marble should be greater than the mass of the other two balls and the size of the marble should be the same, "the marble would have to be the same size, but it could just have a greater mass." The response does not fully or accurately provide an explanation that kinetic energy increases as mass increases, nor does it fully or accurately provide an explanation that keeping the marble the same size will not affect the speed, "the size doesn't really affect the kinetic energy, but speed and mass does."

Response 4

The mass should be bigger and the size. The reason is because the more mass the faster you go. The kinetic energy is faster when lower and bigger and the mass is more.

Score: 0

This response earns a 0. It does not accurately explain that the mass of the marble should be greater than the mass of the other two balls and the size of the marble should be the same, "The mass should be bigger and the size." The response does not accurately provide an explanation that kinetic energy increases as mass increases, nor does it accurately provide an explanation that keeping the marble the same size will not affect the speed, "the more mass the faster you go. The kinetic energy is faster when lower and bigger and the mass is more."

Part C

One student wants to change the track so that the potential energy of the marble from point 1 to point 5 is constant. Explain how the student could change the track so that that the potential energy of the marble is constant and explain why that change will keep the potential energy constant.

Response 1

To get the tracks potential energy to be constant you would have to make the starting position as it is then make point 1-5 flat. You would do this because Once the marble does down hill it will keep a constant potential energy. The heigher something is the more potential energy so since the track is flat it will keep the potential energy the same.

Score: 3

This response earns a 3. It accurately describes a change to make the track equal height from points 1 to 5, “To get the tracks potential energy to be constant you would have to make the starting position as it is then make point 1-5 flat.” The response accurately explains that potential energy depends on height, “The heigher something is the more potential energy.” The response accurately provides an explanation that an equal height throughout the track will result in a constant potential energy, “since the track is flat it will keep the potential energy the same.”

Response 2

The student will have to change the track from 1 to 5 go at a great height and become a flat surface so that the ball would not go downward to create more kinetic energy but to the same amount of potential energy for a period of time.

Score: 2

This response earns a 2. It accurately describes a change to make the track equal height from points 1 to 5, “The student will have to change the track from 1 to 5 go at a great height and become a flat surface.” The response does not explain that potential energy depends on height. The response accurately provides an explanation that an equal height throughout the track will result in a constant potential energy, “to the same amount of potential energy for a period of time.”

Response 3

The student could make all of the blocks to the same height, and that would make the track so that the potential energy of the marble is constant. The change would keep the potential energy constant because if all of the blocks are at the same height, then the track will be at the same height from point 1 to point 5, so the marbles would contain the same gravitational potential energy, which would make it constant.

Score: 1

This response earns a 1. It does not accurately describe a change to make the track an equal height from only points 1 to 5, “The student could make all of the blocks to the same height.” This description does not take into account that the starting position must remain higher in order to put the marble into motion. The response does not explain that potential energy depends on height. The response accurately provides an explanation that an equal height throughout the track will result in a constant potential energy, “then the track will be at the same height from point 1 to point 5, the marbles would contain the same gravitational potential energy, which would make it constant.”

Response 4

The student would change all of the of the blocks to the same height so they could keep going at the same pace.

Score: 0

This response earns a 0. It does not accurately describe a change to make the track an equal height from only points 1 to 5, “The student would change all of the of the blocks to the same height.” This description does not take into account that the starting position must remain higher in order to put the marble into motion. The response does not explain that potential energy depends on height. The response does not accurately provide an explanation that an equal height throughout the track will result in a constant potential energy.

Session 2 Item 22 (TPI) - Rubric

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

The Red Bayou project in northwest Louisiana allows farmers to use river water diverted from the Red River when irrigating their crops.

Part A

Select the correct answer from **each** drop-down menu to complete the sentences.

The amount of groundwater used for irrigation most likely [decreased] as more diverted river water became available. The amount of surface water used for irrigation most likely [increased] as more diverted river water became available.

Part B

Which change would **most likely** occur after diverting river water for use in irrigation?

(a) an increase in soil erosion in the river

(b) an increase in flooding in the river

(c) an increase in the amount of water needed to water crops

(d) an increase in sediment, nutrients, and salts on crop soil

Session 2 Item 23 (TPI) - Rubric

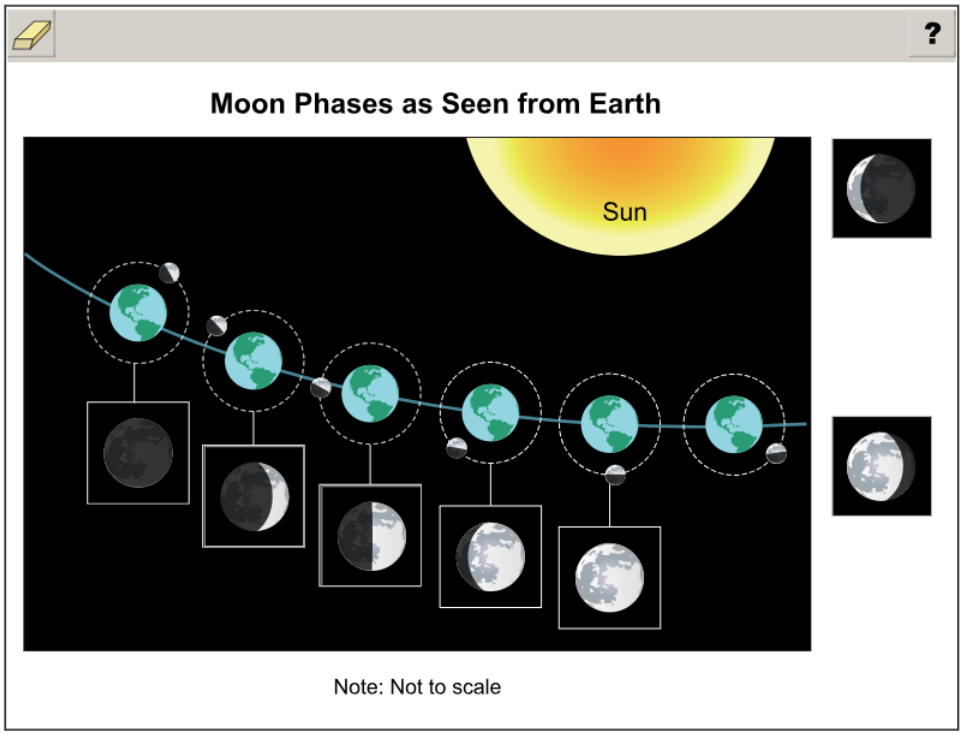
Use the information and your knowledge of science to answer the questions.

Part A

Observers from Earth see different phases of the Moon over time as the Moon orbits around Earth.

Drag the phases of the Moon into the correct boxes to complete the model showing how the phases of the Moon look from Earth.

Not all phases of the Moon will be used.



Note: In Accommodated form, Answer will be Phase Z in first box, and Phase X in second box.

Part B

Based on the information in the Moon phase model, which statement **best** predicts how the phases of the Moon will look as the Moon continues its orbit around Earth in the model?

(a) The Moon will become brighter with no dark areas as the Moon moves closer to the Sun.

(b) The Moon will again appear completely dark and the dark area will decrease in size until the Moon is completely bright.

(c) A dark area will start to appear on the right side of the Moon and will slowly increase in size until the Moon is completely dark.

(d) A dark area will start to appear on the left side of the Moon and will slowly increase in size until the Moon is completely dark.

Session 3 Item 25 (TEI) – Rubric

Based on Figure 2 and Figure 3, select the correct answer from **each** drop-down menu to complete the paragraph.

A magnetic compass needle is able to detect the direction of Earth's magnetic North Pole. Over hundreds of thousands of years, the direction in which a compass needle points would [change ▾]. During a normal polarity period, a compass needle points mostly in the direction of the [geographic North Pole ▾]. After a magnetic pole reversal, a compass needle points mostly in the direction of the [geographic South Pole ▾].

Scoring Notes:

This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 3 correct responses; therefore 1 point will be awarded if the student selects 2 correct responses.

Session 3 Item 26 (TEI)

Scientists will study how Earth's magnetic field changes as distance from Earth changes. Satellites will be placed at different distances from Earth and will be used to measure the strength of Earth's magnetic field.

Drag the correct label into **each** box in the table to identify the dependent and independent variables in the investigation.

Not all labels will be used.

Variable	Property
dependent variable	
independent variable	

magnetic field strength
distance from Earth
size of satellite
mass of satellite
gravitational force of Earth

OK

Session 3 Item 26 (TEI) - Rubric

Variable	Property
dependent variable	magnetic field strength
independent variable	distance from Earth

size of satellite

mass of satellite

gravitational force of Earth

OK

Session 3 Item 27 (CR)

Scientists are planning an investigation to collect evidence to help predict future magnetic pole reversals of Earth's magnetic field. Using the information in Figure 3, describe how scientists can collect data on changes in Earth's magnetic poles and explain how this data can be used to predict future magnetic pole reversals.

Scoring Information	
Score	**Description**
2	Student's response correctly describes how scientists can collect data on changes in Earth's magnetic poles AND correctly explains how this data can be used to predict future magnetic pole reversals.
1	Student's response correctly describes how scientists can collect data on changes in Earth's magnetic poles OR correctly explains how this data can be used to predict future magnetic pole reversals.
0	Student's response does **not** correctly describe how scientists can collect data on changes in Earth's magnetic poles or correctly explain how this data can be used to predict future magnetic pole reversals. **OR** Student's response is blank, irrelevant, or too brief to evaluate.

Scoring Notes:

- Description of how scientists can collect data on changes in Earth's magnetic poles (1 point)
- Explanation of how this data can be used to predict future magnetic pole reversals (1 point)

Examples include:

- The scientists can use the ocean floor rocks to measure the amount of time between each change in direction of the magnetic fields of the rocks (1 point) and then use that data to estimate when Earth's magnetic poles will reverse in future years (1 point)

Accept other reasonable answers.

Session 3 Item 30 (TEI) - Rubric

Select the correct answer from the drop-down menus to complete each sentence.

During the Great Drought, a decrease in the [growth of corn ▾] had the greatest impact on the survival of the Anasazi people. As conditions changed, the Anasazi relied [more ▾] on domesticated turkeys and [rabbits ▾] for food.

Scoring Notes:

This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 3 correct responses; therefore 1 point will be awarded if the student selects 2 correct responses.

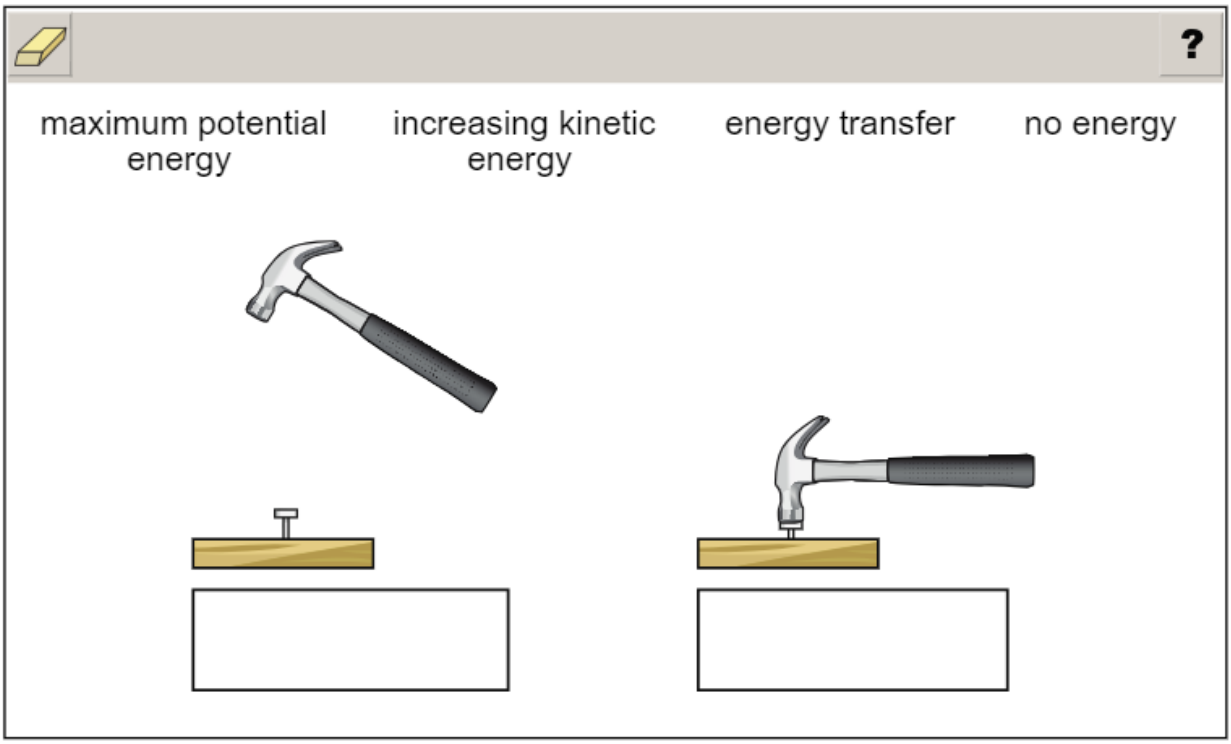
Session 3 Item 35 (TEI)

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

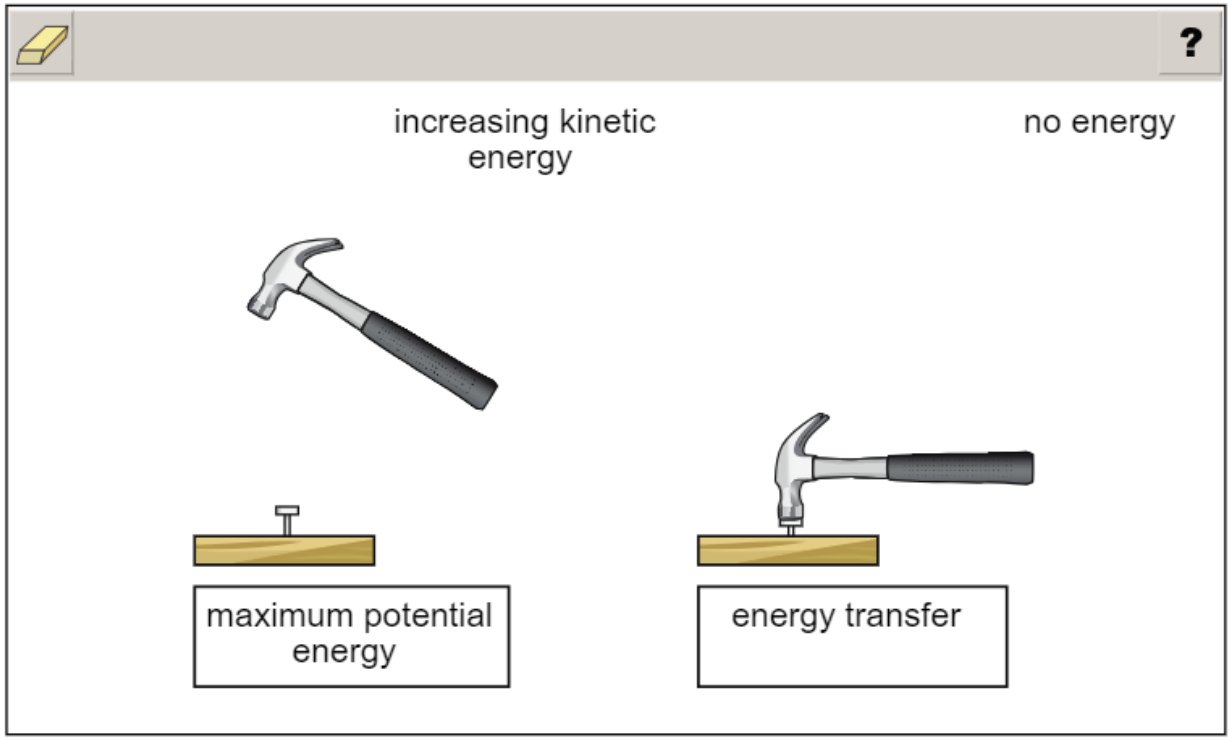
The model shows a hammer and a nail in two positions. The first position shows the hammer in a resting position above the nail. The second position shows when the hammer makes contact with the nail.

Drag the labels into the correct boxes in the model to **best** describe each position of the hammer and the nail.

Not all labels will be used.



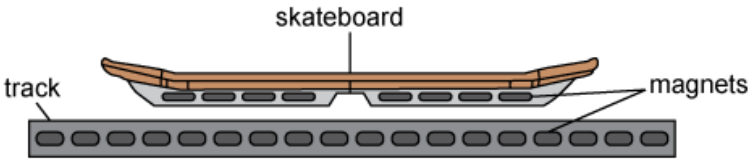
Session 3 Item 35 (TEI) - Rubric



Session 3 Item 37 (TEI) - Rubric

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

Engineers have recently designed skateboards that use magnets to float along a track, as shown in the figure.



Select the correct answer from **each** drop-down menu to complete the paragraph about the design of these skateboards.

The engineers observed that the skateboard floats above the track because the magnets on the skateboard [repel] the magnets on the track. When a rider steps onto the skateboard, the force between the skateboard and the track [increases]. If the magnets are removed from the skateboard, the height of the skateboard should [decrease].

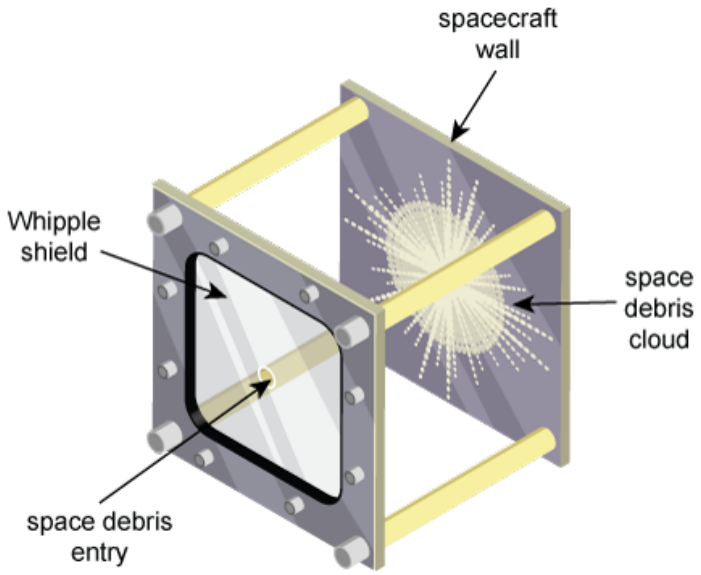
Scoring Notes:

This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 3 correct responses; therefore 1 point will be awarded if the student selects 2 correct responses.

Session 3 Item 40 (TEI) - Rubric

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

Whipple shields are used to protect spacecraft from collisions with smaller pieces of space debris, as shown in the image. The shield uses a layer of aluminum to break up pieces of incoming space debris into much smaller pieces before they collide with the spacecraft.



Select the correct answer from **each** drop-down menu to complete the paragraph.

During a collision between a smaller space debris piece and the spacecraft wall, the force of the space debris piece is [equal to] the force of the spacecraft wall. The force of the space debris piece is directed [toward the wall].

The force of the spacecraft wall is directed [toward the piece].

Engineers can further reduce the force of incoming space debris on the spacecraft by slightly [increasing] the thickness of the aluminum layer.

Scoring Notes:

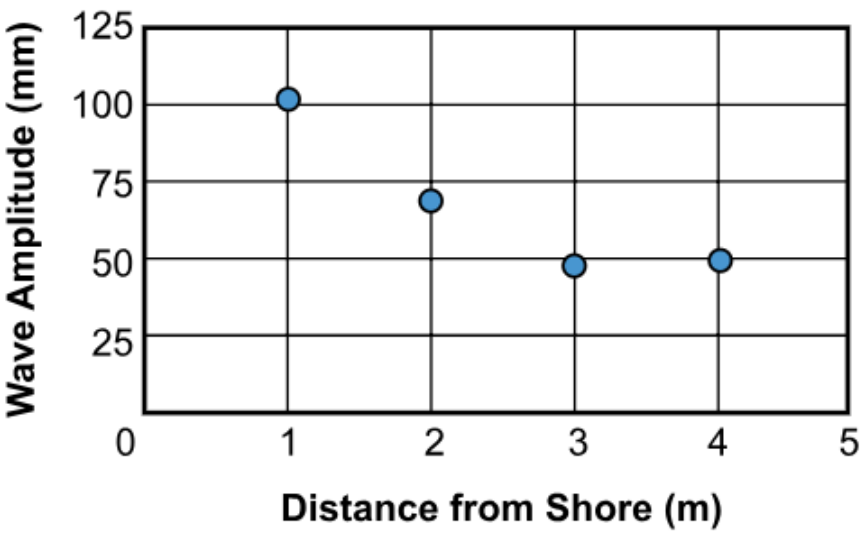
This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 4 correct responses; therefore 1 point will be awarded if the student selects 2 or more correct responses.

Session 3 Item 41 (TEI)

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

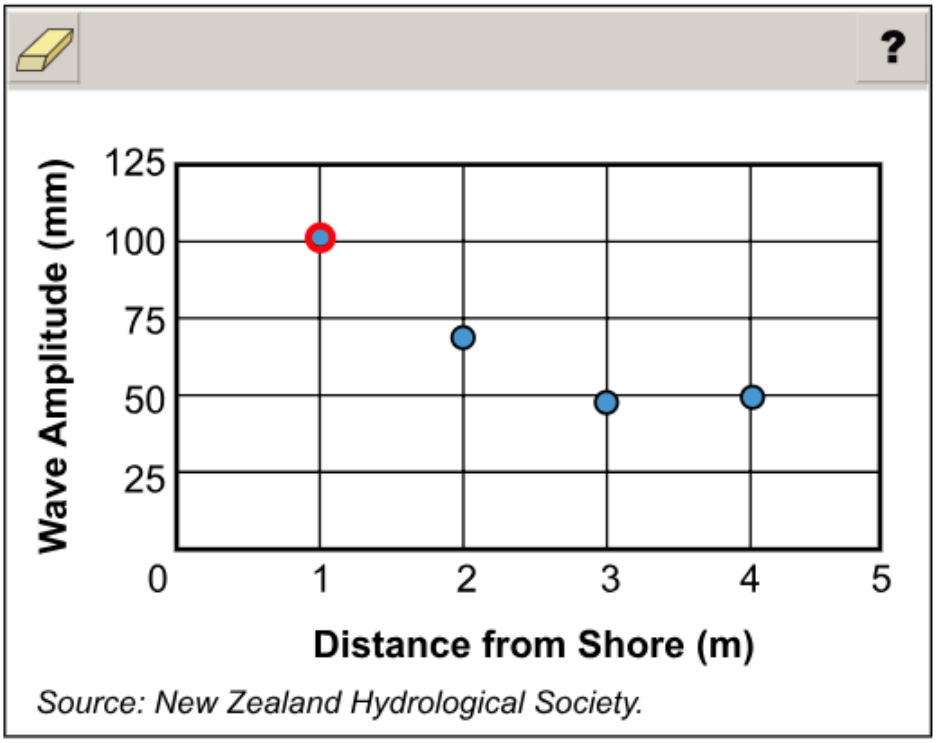
An observer standing on the shore of a lake noticed that boats traveling through the water produce waves of different sizes. The observer collected data on how the amplitude of waves from a boat changes as the waves moves closer to the shore. The data from these observations are shown in the graph.

Select the data point that shows when the waves from the boat have the **most** energy.



Source: New Zealand Hydrological Society.

Session 3 Item 41 (TEI) - Rubric



Source: New Zealand Hydrological Society.