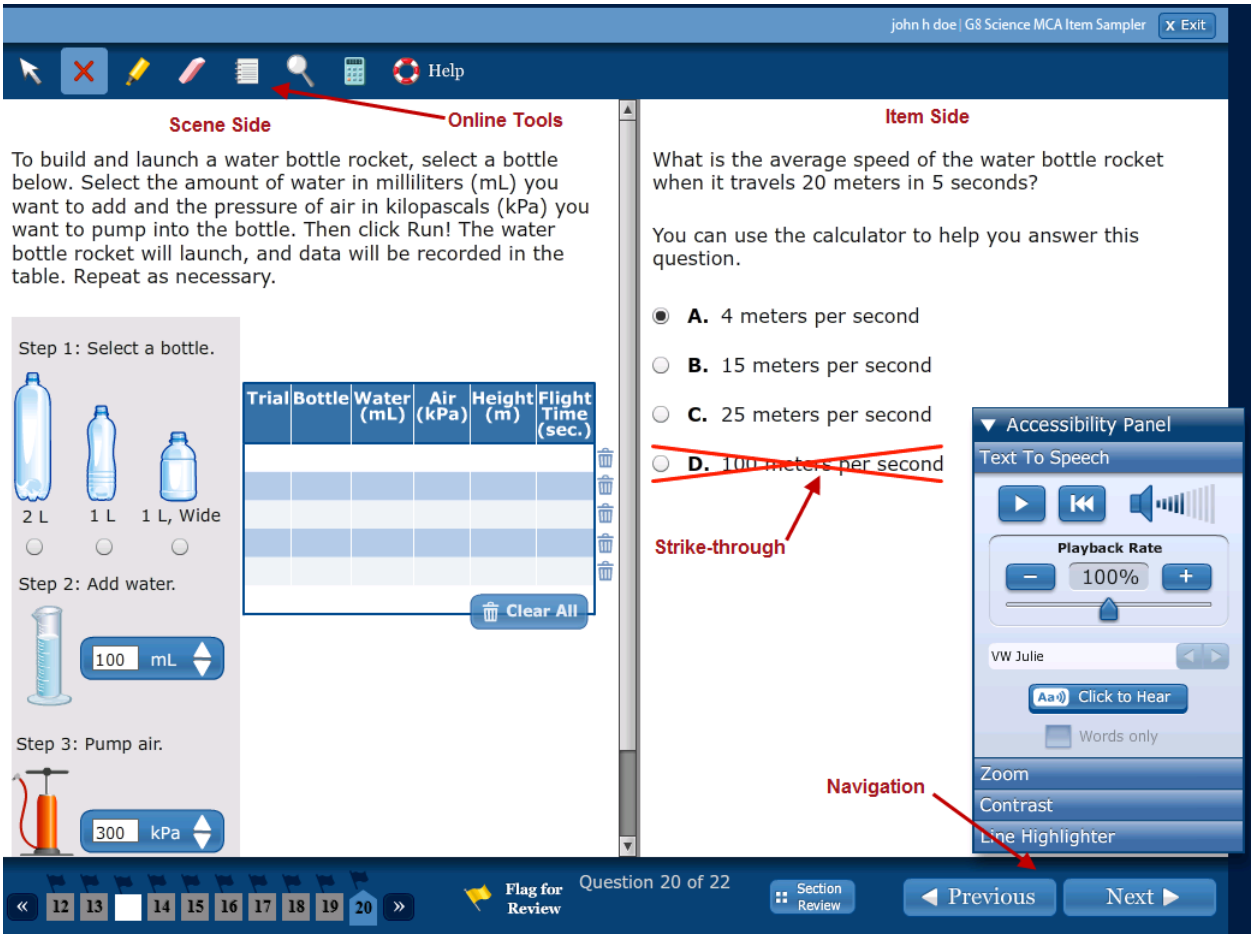
Minnesota Department of Education

Grade 8
Science MCA-III Item Sampler
Teacher Guide

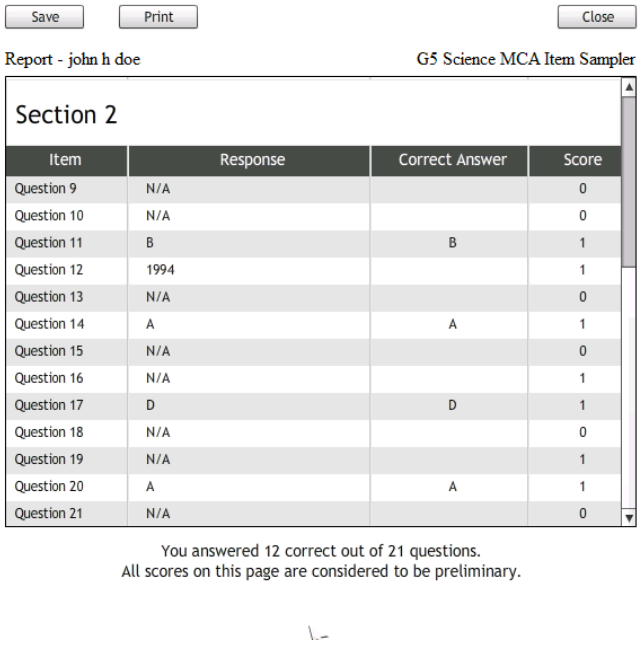
Test Design and Navigation

- Screen is split vertically, scene on left and questions on right
- Students are required to answer the question on the page before they can go on, but they can mark individual questions for later review
- A review screen at the end of a section reminds students about the questions they marked for review and provides an opportunity to review any questions in that section
- Text-to-speech (TTS) is available on all items. Accommodated text is available for graphics and tables, but needs to be part of the student's IEP or EL designation
- Online tools include a highlighter, strike-through text options, magnifier, notepad, and a calculator if needed. Additional tools are available in an accessibility panel including text to speech, screen contrast and zoom function.
- All items in the item samplers are worth one point.



Score report

Upon completion of the Item Samplers, a Score Report is displayed. This report can be saved to a designated place or printed. Only the Multiple Choice questions are displayed with the student's response and correct answer. The Technology Enhanced questions are scored but the student response and correct answer is not displayed on the report. This teacher guide provides the correct answers for this type of question.


Save Print Close

Report - john h doe G5 Science MCA Item Sampler

Section 2

Item	Response	Correct Answer	Score
Question 9	N/A		0
Question 10	N/A		0
Question 11	B	B	1
Question 12	1994		1
Question 13	N/A		0
Question 14	A	A	1
Question 15	N/A		0
Question 16	N/A		1
Question 17	D	D	1
Question 18	N/A		0
Question 19	N/A		1
Question 20	A	A	1
Question 21	N/A		0

You answered 12 correct out of 21 questions.
All scores on this page are considered to be preliminary.

Purpose of the Item Samplers

Item samplers are provided to help teachers and students become familiar with the format and type of content included in the MCAs. Item samplers contain fewer items than an actual full-length test and are aligned to the Minnesota Academic Standards. They are not suitable for predicting how students will perform on the MCAs.

For more information on the proportions of items aligned to each standard and clarifications on how each standard will be assessed, see the MCA-III Test Specifications for Science at http://www.education.state.mn.us/MDE/EdExc/Testing/TestSpec/index.html.

The Item Samplers and other testing resources, like the Online MCA Tutorials, can be found at www.pearsonaccess.com .

Cognitive Complexity

Cognitive complexity refers to the cognitive demand associated with an item. The level of cognitive demand focuses on the type and level of thinking and reasoning required of the student on a particular item. MCA-III levels of cognitive complexity are based on Norman L. Webb's Depth of Knowledge[1] levels. Although certain verbs, such as "recall," "classify" or "reason," are commonly associated with specific cognitive levels, Webb's Depth of Knowledge (DOK) levels are **not** determined by the verbs that describe them, but rather the contexts in which the verbs are used and the depth of thinking required.

DOK 1 (recall) items require the recall of information such as a fact, definition, term or simple science process or procedure.

DOK 2 (skill/concept) items call for the engagement of some mental processing beyond a habitual response, with students required to make some decisions as to how to approach a problem or activity.

DOK 3 (strategic thinking) items require students to reason, plan or use evidence to solve a problem.

The MCA-III Science Test Specifications give a more detailed explanation of DOK levels used in the MCA-III assessments.

If you have further questions concerning the MCA Science Assessments please contact the following MDE staff:

Dawn Cameron, dawn.cameron@state.mn.us, 651-582-8551

Jim Wood, jim.wood@state.mn.us, 651-582-8541

[1] Webb, N. L. Alignment of science and mathematics standards and assessments in four states (Research Monograph No. 18). Madison: University of Wisconsin – Madison, National Institute for Science Education, 1999.

Scenario: How Does a Garden Grow

Question 1

Benchmark:

7.4.2.1.3- Explain how the number of populations an ecosystem can support depends on the biotic resources available as well as abiotic factors such as amount of light and water, temperature range and soil composition.

DOK: 1

Answer: B

Rationale: Bacteria are living and therefore this factor is biotic.

This student is growing a garden. In her garden, she is growing many types of fruits and vegetables, including bell peppers.

Which factor affecting the growth of pepper plants is a living factor?

- **A.** The temperature of the air
- **B.** The kinds of bacteria living in the soil
- **C.** The amount of water the plants receive
- **D.** The amount of sunlight the plants receive

Question 2

Benchmark:

7.4.2.2.1- Recognize that producers use the energy from sunlight to make sugars from carbon dioxide and water through a process called photosynthesis. This food can be used immediately, stored for later use, or used by other organisms.

DOK: 1

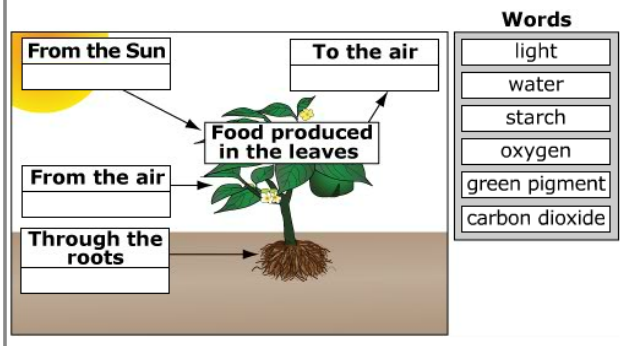
Answer: From the Sun=**“**light”; To the air=“oxygen”; From the air=“carbon dioxide”; Through the roots=“water”.

Rationale: Each photosynthetic reactant (carbon dioxide, light and water) and product (glucose and oxygen) is matched to the source of these reactants and products.

The student is planning an experiment to determine how the amount of light a pepper plant receives affects the amount of fruit it produces. To prepare for her experiment, she reviews photosynthesis and why it is important in making fruit. She draws a diagram of a pepper plant and all the parts of photosynthesis.

This diagram shows the process of photosynthesis. Identify the parts of the photosynthesis process involved in this ecosystem.

Drag the words into the diagram.



Accessibility Panel

Text To Speech

Question 3

Benchmark:

> 7.1.1.2.2 Plan and conduct a controlled experiment to test a hypothesis about a relationship between two variables, ensuring that one variable is systematically manipulated, the other is measured and recorded, and any other variables are kept the same (controlled). *For example:* The effect of various factors on the production of carbon dioxide by plants.

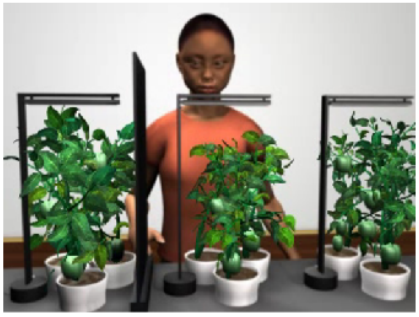
DOK: 1

Answer: “The number of pots in each group” AND “The number of plants per pot” AND “The type of plant” are selected.

Rationale: Using the description of the investigation on the left side, the changed variable is the hours of light per day given to each group and all other variables are kept the same.

The student tests how the amount of light a pepper plant receives affects the mass of the plants. She sets up 9 pots, each with 1 pepper plant.

The plants are divided into 3 groups with 3 plants in each group. The first group receives 8 hours of light per day. The second group receives 12 hours of light per day. The third group receives 18 hours of light per day.



Accessibility Panel

Text To Speech

Identify each variable that is controlled in this investigation.

Select each variable you want to choose.

The hours of light per day the plants receive	The number of pots in each group
The number of plants per pot	The type of plant

Scenario: Properties of Matter Investigation

Question 4

Benchmark:

> 6.2.1.2.2 Describe how mass is conserved during a physical change in a closed system. *For example:* The mass of an ice cube does not change when it melts.

DOK: 2

Answer: “Mass” AND “Phase” AND “Volume” are selected

Rationale: Pouring water into a different container will only result in a change of shape since there is no chemical reaction occurring or change in temperature resulting in a phase change.

Two students are completing an investigation on the properties of matter. They start by measuring the mass of 50 milliliters of water.

Accessibility Panel

Text To Speech

Which properties of the water do **not** change when it is poured from the beaker into the graduated cylinder?

Select the properties you want to choose.

Properties

- [ ] Mass
- [ ] Phase
- [ ] Shape
- [ ] Volume

Question 5

Benchmark:

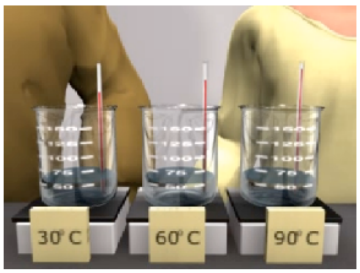
6.2.3.2.3- Describe how heat energy is transferred in conduction, convection and radiation.

DOK: 1

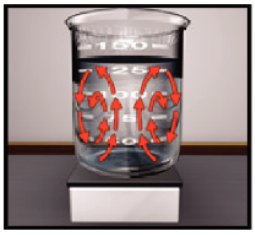
Answer: B

Rationale: Convection involves the transfer of heat in liquids and gases.

In order to compare the effect of temperature on the dissolving rate of sugar, the students prepare 3 beakers of water at different temperatures, one at 30°C, one at 60°C, and one at 90°C.



Which method of heat transfer is shown by the arrows?



- **A.** Conduction
- **B.** Convection
- **C.** Precipitation
- **D.** Radiation

Question 6

Benchmark:

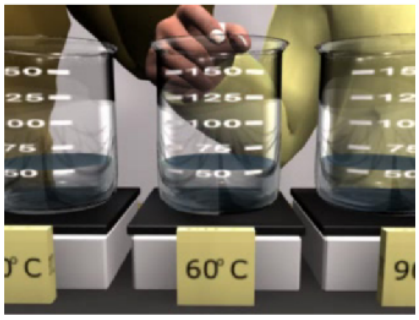
6.2.1.1.1- Explain density, dissolving, compression, diffusion and thermal expansion using the particle model of matter.

DOK: 2

Answer: B

Rationale: The molecules of the sugar cube are broken down into individual sugar molecules and are absorbed into the spaces between the water molecules.

The students now add a sugar cube into each beaker of water, while stirring the water.



As the sugar crystals disappear, what is happening to the sugar molecules?

- **A.** They combine with the water molecules.
- **B.** They enter the spaces between the water molecules.
- **C.** They evaporate into the air.
- **D.** They separate into smaller pieces called atoms.

Question 7

Benchmark:

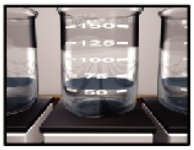
6.2.1.2.3- Use the relationship between heat and the motion and arrangement of particles in solids, liquids and gases to explain melting, freezing, condensation and evaporation.

DOK: 2

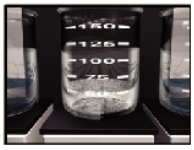
Answer: B

Rationale: After heating, water has evaporated and changed to water vapor.

One of the beakers of sugar water is heated at a very slow rate, using a hotplate, until all of the water is gone. Notice there is a substance left in the beaker.



Before Heating



After Heating

Which of the following statements best describes what happened to the water?

- **A.** The water changed into a solid.
- **B.** The water changed state from a liquid to a gas.
- **C.** The water changed into hydrogen and oxygen.
- **D.** The water changed state from a liquid to a solid.

Question 8

Benchmark:

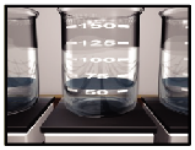
8.2.1.2.2- Distinguish between chemical and physical changes in matter.

DOK: 2

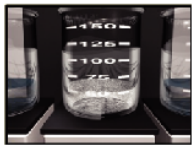
Answer: D

Rationale: A physical change has taken place because the sugar can be separated from the water by another physical process (evaporation).

One of the beakers of sugar water is heated at a very slow rate, using a hotplate, until all of the water is gone. Notice there is a substance left in the beaker.



Before Heating



After Heating

The substance that is left in the beaker is sugar. Based on this fact, what type of change took place when the sugar dissolved in the water?

- **A.** Chemical
- **B.** Electrical
- **C.** Mechanical
- **D.** Physical

Question 9

Benchmark:

6.1.3.4.1- Determine and use appropriate safe procedures, tools, measurements, graphs, and mathematical analyses to describe and investigate natural and designed systems in a physical science context.

DOK: 1

Answer: Left bar to 30 seconds, middle bar to 15 seconds, and right bar to 5 seconds

Rationale: Student takes the data from the table and records the number of seconds for each beaker's temperature.

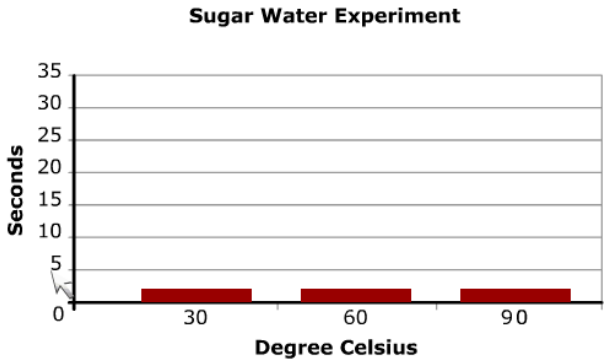
The data that was recorded from dissolving sugar is shown in the table below.

Sugar Water Experiment

Beaker 1	Beaker 2	Beaker 3
30°C	60°C	90°C
30 sec	15 sec	5 sec

The data show results of the experiment. Make a graph of this data.

Select a point above each bar where the top of the bar should be.



Accessibility Panel

Text To Speech

Question 10

Benchmark:

8.1.1.2.1-Use logical reasoning and imagination to develop descriptions, explanations, predictions and models based on evidence.

DOK: 2

Answer: Multiple correct answers. Any number greater than 0 and less than 5 seconds.

Rationale: The 90 degree Celsius beaker took 5 seconds to dissolve so a beaker with 100 degree Celsius water will take less time.

The data that was recorded from dissolving sugar is shown in the table below.

Sugar Water Experiment

Beaker 1	Beaker 2	Beaker 3
30°C	60°C	90°C
30 sec	15 sec	5 sec

The students slowly heat a fourth beaker to 100°C. Using the data they have collected the students want to predict how long it will take for the sugar to dissolve in this beaker.

Predict how long it will take the sugar to dissolve, based on the student's data.

Enter your answer in the box.

sec

Scenario Name-Weather

Question 11

Benchmark:

8.3.2.3.1- Describe the location, composition and use of major water reservoirs on the Earth, and the transfer of water among them.

DOK: 2

Answer: A

Rationale: As the air temperature increases, the air molecules move faster and get farther apart creating more room for the water molecules. The increase in temperature also causes the phase change from liquid water (fog) to water vapor.

On the way to school, students saw fog in low-lying areas. Students also noticed that the air was very calm, and there was little wind.

Later in the day the sun moves higher in the sky and the temperature increases. The fog cannot be seen. How does the air temperature increase during the day affect the water in the fog?

- **A.** The increasing temperature keeps the water in the atmosphere.
- **B.** The increasing temperature moves the water to local lakes.
- **C.** The increasing temperature forces the water underground.
- **D.** The increasing temperature returns the water to the ocean.

Question 12

Benchmark:

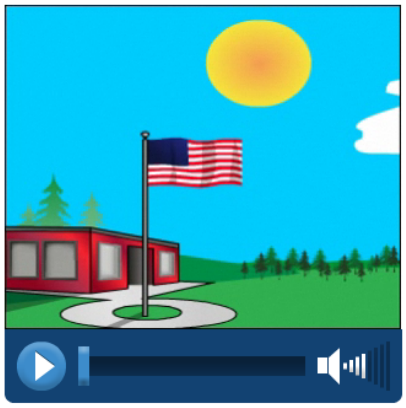
8.3.2.1.3- Explain how heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and hydrosphere producing winds, ocean currents and the water cycle, as well as influencing global climate.

DOK: 2

Answer: C

Rationale: The Sun heating the air unequally produces winds.

Later that morning, students saw the flag blowing in the wind.



Which statement explains why winds are often weaker at night and get stronger during the day?

- **A.** Wind results from changes in the water vapor content of the air.
- **B.** Wind results when rain or snow falls from clouds.
- **C.** Wind results from unequal heating of the air.
- **D.** Wind results where skies change from cloudy to clear.

Accessibility Panel
Text To Speech

Question 13

Benchmark:

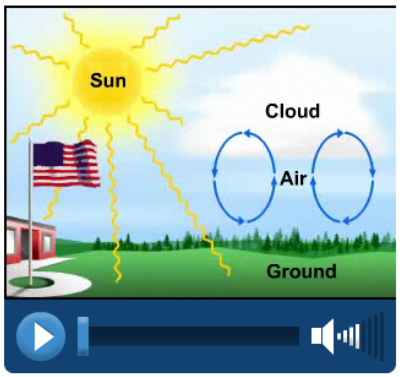
6.2.3.2.3- Describe how heat energy is transferred in conduction, convection and radiation.

DOK: 1

Answer: “Radiation” in the left box and “Convection” in the right box

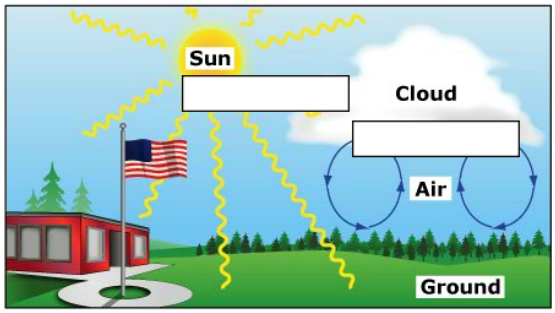
Rationale: The sun transfers energy by radiation and the air transfers energy by convection.

The energy that drives our weather is transferred through several processes.



Identify the processes of energy transport that affect Earth and its atmosphere.

Drag the processes into the diagram.



Processes

Convection | Conduction | Precipitation | Condensation | Radiation

Accessibility Panel

Text To Speech

Scenario: Water Bottle Rockets

Question 14

Benchmark:

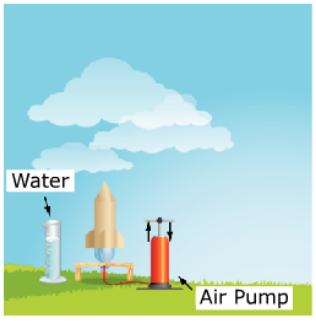
6.1.3.4.1- Determine and use appropriate safe procedures, tools, measurements, graphs, and mathematical analyses to describe and investigate natural and designed systems in a physical science context.

DOK: 1

Answer: C

Rationale: Graduated cylinders are used to measure the volume of liquids.

Water bottle rockets are made by adding water to a bottle and pumping air into it. The flight time and height depend on the shape and the size of the water bottle rocket and the amounts of water and air you pump into the bottle.



Which tool best measures the volume of water put into the water bottle rocket?

- **A.** Timer
- **B.** Metric ruler
- **C.** Graduated cylinder
- **D.** Celsius thermometer

Question 15

Benchmark:

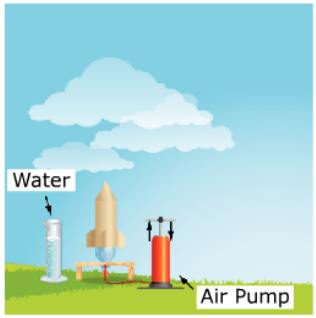
6.1.3.4.2- Demonstrate the conversion of units within the International System of Units (SI, or metric) and estimate the magnitude of common objects and quantities using metric units.

DOK: 1

Answer: 0.65

Rationale: Using the conversion factor 1000 milliliters = 1 liter, solve X liters = 650 ml/1000 ml.

Water bottle rockets are made by adding water to a bottle and pumping air into it. The flight time and height depend on the shape and the size of the water bottle rocket and the amounts of water and air you pump into the bottle.



650 milliliters of water is put into the water bottle. Convert 650 milliliters to liters.

You can use the calculator to help you answer this question.

Enter your answer in the box.

650 milliliters = _____ liters

Accessibility Panel
Text To Speech

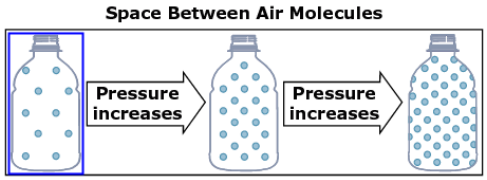
Question 16

Benchmark:

6.2.1.1.1- Explain density, dissolving, compression, diffusion and thermal expansion using the particle model of matter.

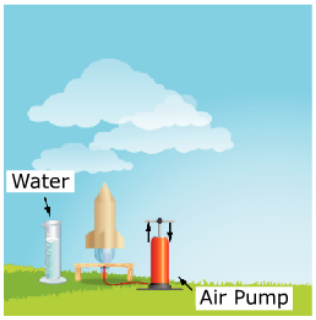
DOK: 1

Answer:



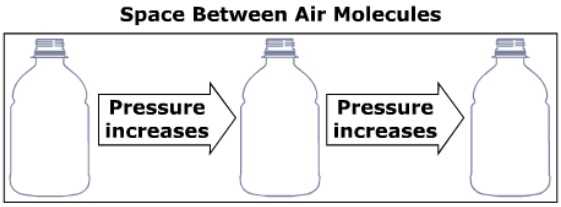
Rationale: As the pressure increases the distance between molecules decreases.

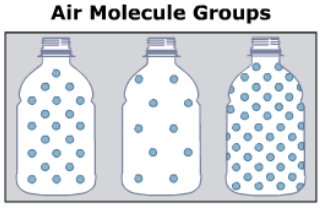
Water bottle rockets are made by adding water to a bottle and pumping air into it. The flight time and height depend on the shape and the size of the water bottle rocket and the amounts of water and air you pump into the bottle.



Complete the diagram to show how the space between air molecules changes as pressure increases in the bottles.

Drag each of the air molecule groups into the diagram.





Question 17

Benchmark:

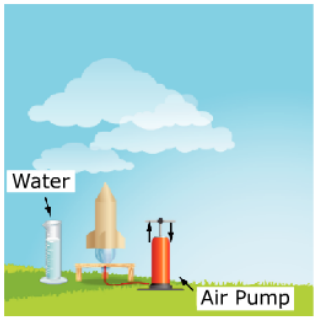
6.2.1.2.1- Identify evidence of physical changes, including changing phase or shape, and dissolving in other materials.

DOK: 1

Answer: D

Rationale: A physical change occurs when a substance dissolves.

Water bottle rockets are made by adding water to a bottle and pumping air into it. The flight time and height depend on the shape and the size of the water bottle rocket and the amounts of water and air you pump into the bottle.



Some of the air that is pumped into the bottle dissolves in the water. What type of change happens when air dissolves in water?

- **A.** Chemical
- **B.** Color
- **C.** Molecular
- **D.** Physical

Accessibility Panel
Text To Speech

Question 17 is the last question in the large print (18 and 24 point) item samplers. Questions 18-23 require online interaction. These types of questions are not included in the Science MCA large print item samplers or the large print test.

Question 18

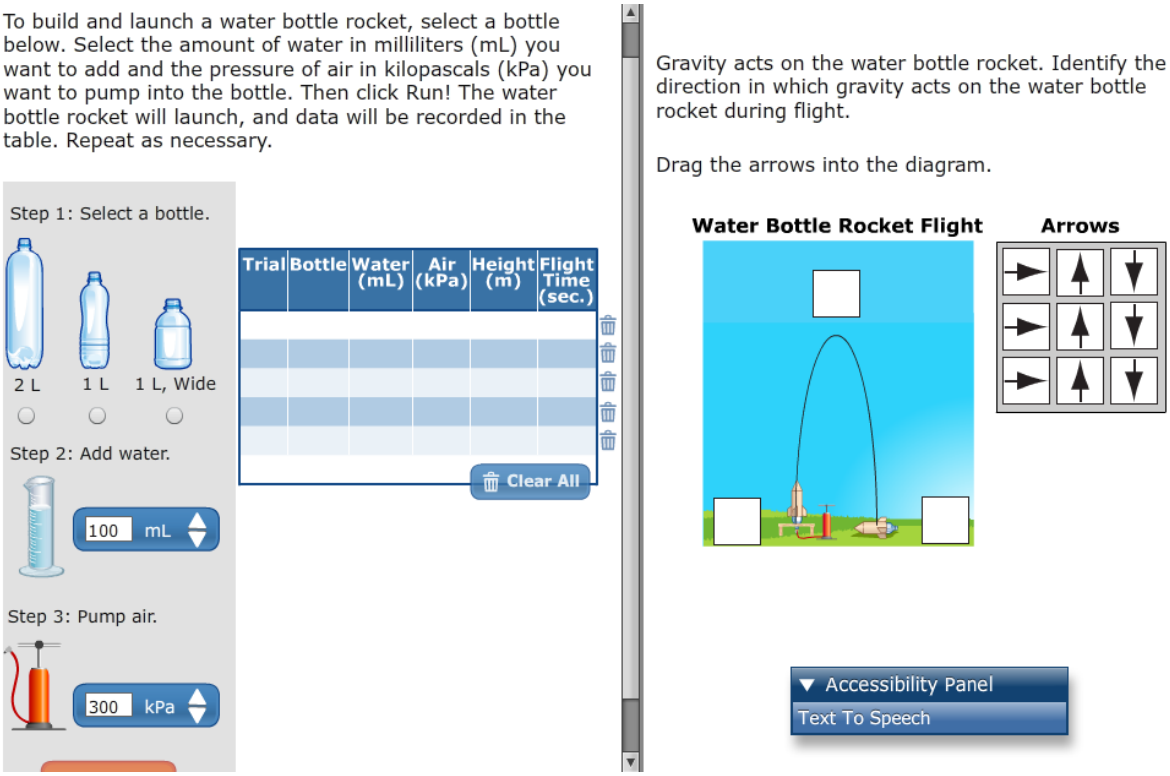
Benchmark:

6.2.2.2.2-Identify the forces acting on an object and describe how the sum of the forces affects the motion of the object. *For example:* Forces acting on a book on a table or a car on the road.

DOK: 2

Answer: A downward arrow in each of the three response boxes

Rationale: Gravity is the attractive force acting between the water bottle and earth. Because the force of gravity is proportional to the masses of the objects, the water bottle would be attracted to earth.



Question 19

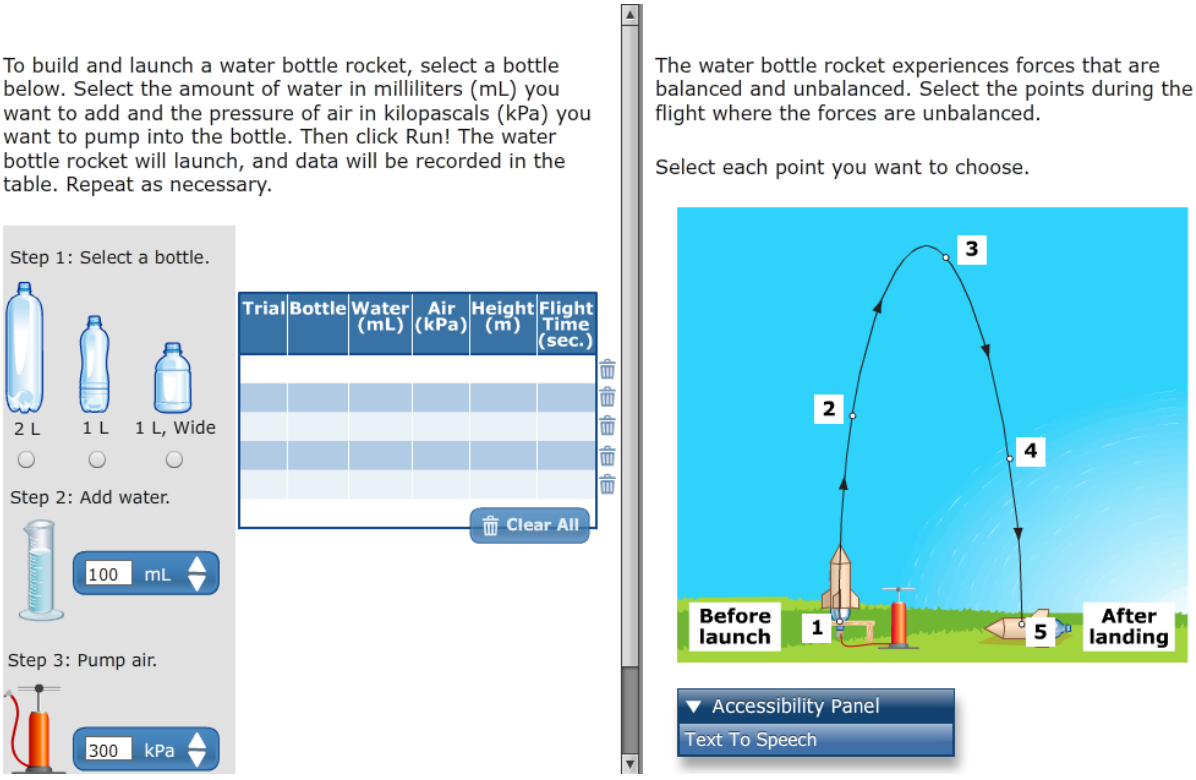
Benchmark:

6.2.2.2.1-Recognize that when the forces acting on an object are balanced, the object remains at rest or continues to move at a constant speed in a straight line, and that unbalanced forces cause a change in the speed or direction of the motion of an object.

DOK: 2

Answer: Positions 2 AND 3 AND 4 are selected

Rationale: Positions 2, 3 and 4 are where the water bottle rocket is accelerating which is the result of unbalanced forces.



Question 20

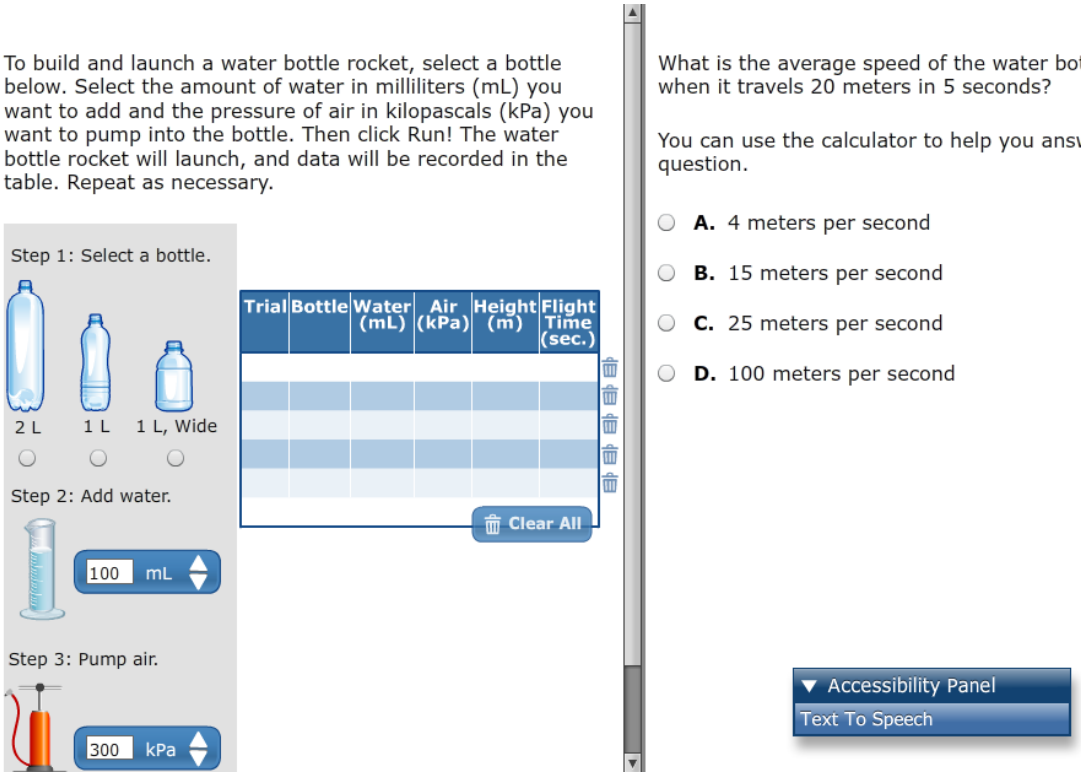
Benchmark:

6.2.2.1.1- Measure and calculate the speed of an object that is traveling in a straight line.

DOK: 1

Answer: A

Rationale: Solving using the formula for speed S=d/t (S= 20/5) the rocket would have a speed of 4 m/s.



Question 21

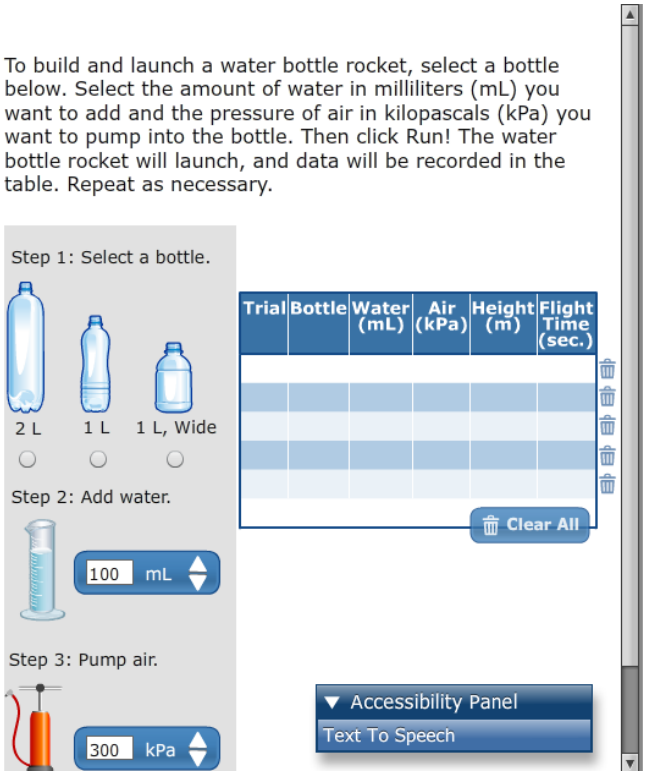
Benchmark:

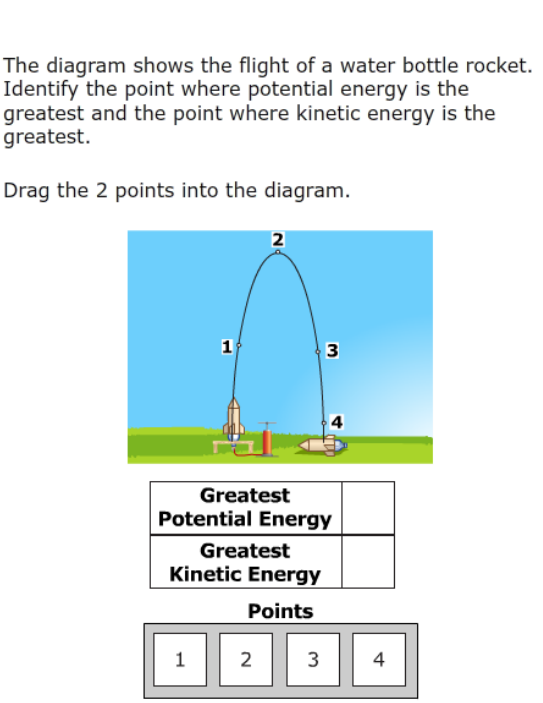
6.2.3.2.1-Differentiate between kinetic and potential energy and analyze situations where kinetic energy is converted to potential energy and vice versa.

DOK: 2

Answer: Greatest Potential Energy=Point 2 AND Greatest Kinetic Energy= Point 4

Rationale: Point 2 is the highest point from the ground which has the highest gravitational potential energy. Point 4 is where the water bottle rocket has the greatest velocity and therefore the greatest kinetic energy.





Question 22

Benchmark:

7.1.1.2.3- Generate a scientific conclusion from an investigation, clearly distinguishing between results (evidence) and conclusions (explanation).

DOK: 3

Answer: C

Rationale: At lower water volumes (100-400ml) the height the rocket travels increases. Using 500ml and up, the height that the rocket travels starts to decrease.