XVI. Science and Technology/Engineering, Grade 5
**Grade 5 Science and Technology/Engineering Test**

The spring 2018 grade 5 Science and Technology/Engineering test was administered in two formats: a computer-based version and a paper-based version. The test included both operational items, which count toward a student’s score, and matrix items. The matrix portion of the test consisted of field-test and equating questions that do not count toward a student’s score. All students were administered the same operational items, regardless of whether they took the computer-based test or the paper-based test.

This document displays the **paper-based versions** of the 2018 operational items that have been released. The **computer-based versions** of the released items are available on the MCAS Resource Center website at [mcas.pearsonsupport.com/released-items](http://mcas.pearsonsupport.com/released-items).

**Test Sessions and Content Overview**

The grade 5 Science and Technology/Engineering test was made up of two separate test sessions. Each session included multiple-choice and open-response questions.

**Standards and Reporting Categories**

The grade 5 Science and Technology/Engineering test was based on overlapping learning standards in the four major content strands in the October 2006 and April 2016 versions of the *Massachusetts Science and Technology/Engineering Curriculum Framework*. The four content strands are listed below.

- Earth and Space Science
- Life Science (Biology)
- Physical Sciences (Chemistry and Physics)
- Technology/Engineering

The 2006 and 2016 versions of the *Massachusetts Science and Technology/Engineering Curriculum Framework* are available on the Department website at [www.doe.mass.edu/frameworks/](http://www.doe.mass.edu/frameworks/).

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

The tables at the conclusion of this chapter indicate each released and unreleased operational item’s reporting category and the learning standard it assesses. The correct answers for released multiple-choice questions are also displayed in the released item table.

**Reference Materials**

During both Science and Technology/Engineering test sessions, the use of bilingual word-to-word dictionaries was allowed for current and former English learner students.
Directions
Read each question carefully and then answer it as well as you can. You must record all answers in your Student Answer Booklet.

For some questions, you will mark your answers by filling in the circles in your Student 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 in your Student Answer Booklet. Only responses written within the provided space will be scored.
The table below shows weather data for four days.

<table>
<thead>
<tr>
<th></th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Temperature (°F)</strong></td>
<td>30</td>
<td>45</td>
<td>53</td>
<td>24</td>
</tr>
<tr>
<td><strong>Low Temperature (°F)</strong></td>
<td>25</td>
<td>39</td>
<td>42</td>
<td>14</td>
</tr>
<tr>
<td><strong>Skies</strong></td>
<td>clear</td>
<td>cloudy</td>
<td>partly cloudy</td>
<td>cloudy</td>
</tr>
<tr>
<td><strong>Wind Speed (mi. per hr)</strong></td>
<td>5</td>
<td>9</td>
<td>15</td>
<td>4</td>
</tr>
</tbody>
</table>

On which day did it **most likely** snow?

A. day 1
B. day 2
C. day 3
D. day 4
A group of students observe some sea stars (also known as starfish) while on a field trip. A sea star is shown in the picture below.

Most of the sea stars have five arms, but two of the sea stars each have an arm that is much shorter than their other arms. A park ranger tells the students that the shorter arms were once missing because they were probably eaten by a fish or a crab, but the arms have started to grow back.

Which of the following best describes how sea stars are able to regrow their arms?

A. Sea stars learn how to regrow their arms.
B. Sea stars inherit the ability to regrow their arms.
C. Sea stars eat food that causes their arms to regrow.
D. Sea stars move to warmer water that causes their arms to regrow.
A dance teacher put up cubbies for students to store their backpacks. The teacher changed the setup of the cubbies, as shown below.

What problem was the dance teacher most likely trying to solve by changing the setup of the cubbies?

A. Some students did not have cubbies.
B. Some students could not reach their cubbies.
C. The cubbies were not large enough for the backpacks.
D. The cubbies did not allow enough space for the dance floor.
The diagram below shows four numbered stages in the life cycle of a ladybug.

Which of the following processes must occur between stage 3 and stage 4 of the life cycle?

A. birth  
B. death  
C. development  
D. reproduction
The diagram below shows four types of finches labeled W, X, Y, and Z.

The type of finch labeled W adapted different traits over a long period of time that resulted in the three different types of finches labeled X, Y, and Z. What is the most likely reason the finches labeled X, Y, and Z adapted different traits from the finch labeled W?

A. to look like other birds
B. to change their environments
C. to copy behaviors of other similar birds
D. to help them survive in their environments
The diagram below shows a student’s design for a pulley system used to lift objects up to a platform.

Which of the following is **most** important to consider when choosing the type of rope for the pulley system?

A. the shape of the pulley bucket handle  
B. the speed at which the pulley wheel moves  
C. the amount of weight the pulley bucket will hold  
D. the distance of the pulley wheel from the platform
The chart below lists some organisms found in an ocean ecosystem.

<table>
<thead>
<tr>
<th>Producer</th>
<th>Herbivore</th>
<th>Carnivore</th>
</tr>
</thead>
<tbody>
<tr>
<td>green algae</td>
<td>surgeonfish</td>
<td>grouper</td>
</tr>
<tr>
<td>sea grass</td>
<td>turtle</td>
<td></td>
</tr>
</tbody>
</table>

A student made the food web below, but some arrows are missing.

Why should the student add arrows from the green algae and the sea grass to the turtle?

A. to show that turtles are sometimes eaten by carnivores
B. to show that turtles can produce food from sunlight and water
C. to show how turtles get energy and materials for growth from producers
D. to show how turtles protect producers from being eaten by other herbivores
18 A student looks into a mirror and sees the wall behind him. Which of the following best describes why the student sees the wall in the mirror?

A. Light reflects off the mirror.
B. Light curves around the mirror.
C. Light passes through the mirror.
D. Light scatters when it hits the mirror.

19 Which of the following best describes how most soil forms?

A. through the growth of trees in a forest
B. through the buildup of snow on an iceberg
C. through the weathering of rock by wind and water
D. through the cooling of lava from a volcanic eruption
This session contains 12 questions.

Directions
Read each question carefully and then answer it as well as you can. You must record all answers in your Student Answer Booklet.

For some questions, you will mark your answers by filling in the circles in your Student 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 in your Student Answer Booklet. Only responses written within the provided space will be scored.
23 A change in the environment of an area caused the leaves of many plants to turn brown. Many of these plants died.

Which of the following changes in the environment most likely caused the plants to die?

A. a long drought
B. an early spring
C. a windy summer
D. a large thunderstorm

24 In a science investigation, a student holds a vibrating tuning fork near a piece of cork, as shown below.

The student observes that the cork moves. Which of the following conclusions can be made from this investigation?

A. Sound is a form of energy.
B. Sound does not travel in air.
C. Sound cannot travel through the cork.
D. Sound is transformed into magnetic energy.
A student builds a compass from a pencil, a clear plastic cup, some thread, and a magnetized needle. The student then brings the north end of a bar magnet near the north end of the needle, as shown below.

![Diagram of compass needle and bar magnet](image)

What happens when the north end of the bar magnet is brought near the north end of the compass needle?

A. The needle and cup stay in place.
B. The needle and cup slide across the table.
C. The north end of the needle sticks to the bar magnet.
D. The north end of the needle spins away from the bar magnet.
The picture below shows trees with bent trunks growing on a hillside.

Soil moving downhill caused these trees to tilt slightly each year when they were young. Which of the following **most likely** caused the soil to move when these trees were young?

A. an earthquake
B. a thunderstorm
C. weathering and erosion
D. volcanic eruptions and lava flows
Some Canada geese pass through Massachusetts as they migrate south in the fall. Which of the following best explains why these birds migrate south in the fall?

A. There is more food in the south during the winter.
B. There is less rainfall in the south during the winter.
C. There are more birds in the south during the winter.
D. There are fewer predators in the south during the winter.

A student took pictures of the Moon on different days. Which set of pictures did the student take on Sunday, Wednesday, and Saturday of the same week?

A.  
B.  
C.  
D.  

B.
In a tropical jungle, some trees produce large, thick leaves that protect their trunks and roots from getting too much sunlight.

Which of the following best explains how these leaves affect the environment where the trees grow?

A. They provide an area for plants that need shade.
B. They increase the amount of rainfall in the region.
C. They transfer heat energy from the air to the ground.
D. They cause many species of animals to become extinct.

A student is testing different types of wood to use for a bookshelf. The student tests each type of wood to predict how many books the bookshelf will safely hold.

Which of the following characteristics of the wood determines how many books the bookshelf can safely hold?

A. flexibility
B. hardness
C. strength
D. weight
Some parts of a sunflower are shown in the diagram below.

A student claims sunflowers reproduce by producing seeds. What part of the sunflower would the student use to support this claim?

A. flower  
B. leaf  
C. root  
D. stem
A student is constructing four different electrical circuits. Each circuit has a battery, wires, a switch, and a light bulb.

Which of the following is the best way for the student to record information so that another student can construct exactly the same four circuits?

A. draw a diagram that shows each circuit
B. make a tally of the parts used in each circuit
C. make a list of the materials needed for each circuit
D. create a graph that shows the number of parts in each circuit
This question has three parts.

There are three states of matter commonly found on Earth. The picture below shows a candle burning. All three states of matter are present when the candle is burning.

Part A

Identify the three states of matter.

Part B

Identify an example of each of the three states of matter present when the candle is burning. Be sure to identify the state of matter for each example.

Each state of matter has certain basic properties.

Part C

For each of the three states of matter, describe one basic property.
This question has four parts.

Four processes are represented in the water cycle diagram shown below. Each process is numbered.

![Water Cycle Diagram]

**Part A**

Identify process 1 of the water cycle and describe how water changes phases in this process.

**Part B**

Identify process 2 of the water cycle and describe how water changes phases in this process.

**Part C**

Identify process 3 of the water cycle and describe one effect temperature can have on water in this process.

**Part D**

Process 4 is runoff. Explain why the amount of runoff is greatest during the spring in Massachusetts.
**Grade 5 Science and Technology/Engineering**

**Spring 2018 Released Operational Items:**

**Reporting Categories, Standards, and Correct Answers**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>339</td>
<td>Earth and Space Science</td>
<td>6</td>
<td>3-ESS2-1</td>
<td>D</td>
</tr>
<tr>
<td>3</td>
<td>340</td>
<td>Life Science</td>
<td>5</td>
<td>3-LS3-2</td>
<td>B</td>
</tr>
<tr>
<td>6</td>
<td>341</td>
<td>Technology/Engineering</td>
<td>2.1</td>
<td>3.3-5-ETS1-1</td>
<td>B</td>
</tr>
<tr>
<td>9</td>
<td>342</td>
<td>Life Science</td>
<td>3</td>
<td>3-LS1-1</td>
<td>C</td>
</tr>
<tr>
<td>10</td>
<td>343</td>
<td>Life Science</td>
<td>6</td>
<td>3-LS4-3</td>
<td>D</td>
</tr>
<tr>
<td>11</td>
<td>344</td>
<td>Technology/Engineering</td>
<td>2.3</td>
<td>4.3-5-ETS1-5(MA)</td>
<td>C</td>
</tr>
<tr>
<td>14</td>
<td>345</td>
<td>Life Science</td>
<td>11</td>
<td>5-LS2-1</td>
<td>C</td>
</tr>
<tr>
<td>18</td>
<td>346</td>
<td>Physical Science</td>
<td>12</td>
<td>4-PS4-2</td>
<td>A</td>
</tr>
<tr>
<td>19</td>
<td>346</td>
<td>Earth and Space Science</td>
<td>4</td>
<td>4-ESS2-1</td>
<td>C</td>
</tr>
<tr>
<td>23</td>
<td>348</td>
<td>Life Science</td>
<td>7</td>
<td>3-LS4-4</td>
<td>A</td>
</tr>
<tr>
<td>24</td>
<td>348</td>
<td>Physical Science</td>
<td>4</td>
<td>4-PS3-2</td>
<td>A</td>
</tr>
<tr>
<td>26</td>
<td>349</td>
<td>Physical Science</td>
<td>9</td>
<td>3-PS2-3</td>
<td>D</td>
</tr>
<tr>
<td>27</td>
<td>350</td>
<td>Earth and Space Science</td>
<td>12</td>
<td>4-ESS1-1</td>
<td>C</td>
</tr>
<tr>
<td>28</td>
<td>351</td>
<td>Life Science</td>
<td>9</td>
<td>3-LS4-4</td>
<td>A</td>
</tr>
<tr>
<td>30</td>
<td>351</td>
<td>Earth and Space Science</td>
<td>15</td>
<td>5-ESS1-2</td>
<td>C</td>
</tr>
<tr>
<td>31</td>
<td>352</td>
<td>Life Science</td>
<td>10</td>
<td>3-LS4-4</td>
<td>A</td>
</tr>
<tr>
<td>36</td>
<td>352</td>
<td>Technology/Engineering</td>
<td>1.1</td>
<td>5-PS1-3</td>
<td>C</td>
</tr>
<tr>
<td>38</td>
<td>353</td>
<td>Life Science</td>
<td>2</td>
<td>4-LS1-1</td>
<td>A</td>
</tr>
<tr>
<td>39</td>
<td>354</td>
<td>Technology/Engineering</td>
<td>2.2</td>
<td>3.3-5-ETS1-4(MA)</td>
<td>A</td>
</tr>
<tr>
<td>41</td>
<td>355</td>
<td>Physical Science</td>
<td>2</td>
<td>5-PS1-1</td>
<td>A</td>
</tr>
<tr>
<td>42</td>
<td>356</td>
<td>Earth and Space Science</td>
<td>10</td>
<td>5-ESS2-1</td>
<td>A</td>
</tr>
</tbody>
</table>

* “PBT Item Number” refers to the position of the item on the operational paper-based test. This is the item number that DESE refers to when reporting student results for a PBT item.

**Answers are provided here for multiple-choice items only. Sample responses and scoring guidelines for open-response items, which are indicated by the shaded cells, will be posted to the Department’s website later this year.
<table>
<thead>
<tr>
<th>PBT Item No.*</th>
<th>Reporting Category</th>
<th>2006 Standard</th>
<th>2016 Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Physical Science</td>
<td>5</td>
<td>4-PS3-2</td>
</tr>
<tr>
<td>4</td>
<td>Earth and Space Science</td>
<td>14</td>
<td>5-ESS1-2</td>
</tr>
<tr>
<td>5</td>
<td>Earth and Space Science</td>
<td>2</td>
<td>5-PS1-3</td>
</tr>
<tr>
<td>7</td>
<td>Physical Science</td>
<td>7</td>
<td>5-PS1-3</td>
</tr>
<tr>
<td>8</td>
<td>Earth and Space Science</td>
<td>13</td>
<td>5-ESS1-2</td>
</tr>
<tr>
<td>12</td>
<td>Life Science</td>
<td>4</td>
<td>3-LS1-1</td>
</tr>
<tr>
<td>13</td>
<td>Life Science</td>
<td>11</td>
<td>5-LS1-1</td>
</tr>
<tr>
<td>15</td>
<td>Technology/Engineering</td>
<td>2.1</td>
<td>4.3-5-ETS1-5(MA)</td>
</tr>
<tr>
<td>16</td>
<td>Earth and Space Science</td>
<td>10</td>
<td>5-ESS2-1</td>
</tr>
<tr>
<td>17</td>
<td>Life Science</td>
<td>6</td>
<td>3-LS4-2</td>
</tr>
<tr>
<td>20</td>
<td>Technology/Engineering</td>
<td>2.1</td>
<td>3.3-5-ETS1-2</td>
</tr>
<tr>
<td>21</td>
<td>Life Science</td>
<td>2</td>
<td>4-LS1-1</td>
</tr>
<tr>
<td>22</td>
<td>Physical Science</td>
<td>6</td>
<td>4-PS3-2</td>
</tr>
<tr>
<td>25</td>
<td>Physical Science</td>
<td>4</td>
<td>4-PS3-2</td>
</tr>
<tr>
<td>29</td>
<td>Physical Science</td>
<td>3</td>
<td>5-ESS2-1</td>
</tr>
<tr>
<td>32</td>
<td>Earth and Space Science</td>
<td>6</td>
<td>3-ESS2-1</td>
</tr>
<tr>
<td>33</td>
<td>Earth and Space Science</td>
<td>9</td>
<td>3-ESS2-2</td>
</tr>
<tr>
<td>34</td>
<td>Physical Science</td>
<td>2</td>
<td>5-PS1-1</td>
</tr>
<tr>
<td>35</td>
<td>Life Science</td>
<td>3</td>
<td>3-LS1-1</td>
</tr>
<tr>
<td>37</td>
<td>Earth and Space Science</td>
<td>2</td>
<td>5-PS1-3</td>
</tr>
<tr>
<td>40</td>
<td>Earth and Space Science</td>
<td>12</td>
<td>4-ESS1-1</td>
</tr>
</tbody>
</table>

* “PBT Item Number” refers to the position of the item on the operational paper-based test. This is the item number that DESE refers to when reporting student results for a PBT item.