Wisconsin Forward Exam

WISCONSIN DEPARTMENT OF PUBLIC INSTRUCTION

# Science
# Item Sampler
# Grade 4

# TABLE OF CONTENTS

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## OVERVIEW

This document contains samples of scenarios and test items similar to those on the Wisconsin Forward Science Exam. Each sample test item has been through a rigorous review process by DRC, Wisconsin Educators, and a third party, to ensure alignment with the Wisconsin Academic Standards. These items will not be used on the state assessment and may, therefore, be used in Wisconsin for professional development and student practice. The items in this document illustrate a sample of the content and types of items that students will encounter on the Forward Exam. A Summary Data table in the Appendix section identifies the alignment (standard measured), answer key, depth of knowledge, and annotations for each item.

## CONNECTION TO THE STANDARDS

Wisconsin Academic Standards for Science are available on the DPI webpage. Test items require students to prove their knowledge and abilities as stated in the standards.

## HOW DO I USE THIS BOOK?

### Professional Development

Sample items are useful as educators engage in conversations about what students are expected to know and be able to do to demonstrate proficiency on the state assessments relative to the Wisconsin Academic Standards. Sample items can inform discussions about state and local standards, curriculum, instruction, and assessment.

### Improving Instruction

Teachers may use sample items in classroom activities that help students understand how to

- solve problems;
- determine which answer choices are correct, which are incorrect, and why;
- approach long and/or multistep tasks;
- use good test-taking strategies.

### Student Practice

Students may perform better and with less anxiety if they are familiar with the format of the test and with the types of items they will be required to answer. The Forward Exam is an online assessment; students will benefit from the use of the Online Tools Training in order to work within the system interface to answer items as they will appear on the assessment, as well as utilize the tools available to them in the online system.

**Note:** A student's score on the practice test cannot be converted to a scale score, used to predict performance on the Forward Exam, or used to make inferences about the student's learning.

## Test Preparation

While using the Item Sampler for test preparation, care should be taken that this is done in a balanced manner and one that helps to enhance student knowledge of subject matter as well as test performance. Please note that test preparation is only useful to the extent that it is also teaching content area knowledge and skills. Therefore, the use of this resource for test preparation is of limited value to students due to the narrow opportunity for content learning. It is very important to ensure that teachers are teaching to the curriculum and not to the test, as teaching to the test narrows the focus of instruction to only that content covered by the test.

# DEPTH OF KNOWLEDGE

**Hess' Cognitive Rigor Matrix & Curricular Examples:** Applying Webb's Depth-of-Knowledge Levels to Bloom's Cognitive Process Dimensions – *M-Sci*

| Revised Bloom's Taxonomy | Webb's DOK Level 1 Recall & Reproduction | Webb's DOK Level 2 Skills & Concepts | Webb's DOK Level 3 Strategic Thinking/ Reasoning | Webb's DOK Level 4 Extended Thinking |
|---|---|---|---|---|
| **Remember**<br>Retrieve knowledge from long-term memory, recognize, recall, locate, identify | ○ Recall, observe, & recognize facts, principles, properties<br>○ Recall/ identify conversions among representations or numbers (e.g., customary and metric measures) | | | |
| **Understand**<br>Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion (such as from examples given), predict, compare/contrast, match like ideas, explain, construct models | ○ Evaluate an expression<br>○ Locate points on a grid or number line<br>○ Solve a one-step problem<br>○ Represent math relationships in words, pictures or symbols<br>○ Read, write, compare decimals in scientific notation | ○ Specify and explain relationships (e.g., non-examples/examples; cause-effect)<br>○ Make and record observations<br>○ Explain steps followed<br>○ Summarize results or concepts<br>○ Make basic inferences or logical predictions from data/observations<br>○ Use models /diagrams to represent or explain mathematical concepts<br>○ Make and explain estimates | ○ Use concepts to solve non-routine problems<br>○ Explain, generalize, or connect ideas using supporting evidence<br>○ Make and justify conjectures<br>○ Explain thinking when more than one response is possible<br>○ Explain phenomena in terms of concepts | ○ Relate mathematical or scientific concepts to other content areas, other domains, or other concepts<br>○ Develop generalizations of the results obtained and the strategies used (from investigation or readings) and apply them to new problem situations |
| **Apply**<br>Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task | ○ Follow simple procedures (recipe-type directions)<br>○ Calculate, measure, apply a rule (e.g., rounding)<br>○ Apply algorithm or formula (e.g., area, perimeter)<br>○ Solve linear equations<br>○ Make conversions among representations or numbers, or within and between customary and metric measures | ○ Select a procedure according to criteria and perform it<br>○ Solve routine problem applying multiple concepts or decision points<br>○ Retrieve information from a table, graph, or figure and use it to solve a problem requiring multiple steps<br>○ Translate between tables, graphs, words, and symbolic notations (e.g., graph data from a table)<br>○ Construct models given criteria | ○ Design investigation for a specific purpose or research question<br>○ Conduct a designed investigation<br>○ Use concepts to solve non-routine problems<br>○ Use & show reasoning, planning, and evidence<br>○ Translate between problem & symbolic notation when not a direct translation | ○ Select or devise approach among many alternatives to solve a problem<br>○ Conduct a project that specifies a problem, identifies solution paths, solves the problem, and reports results |
| **Analyze**<br>Break into constituent parts, determine how parts relate, differentiate between relevant-irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct | ○ Retrieve information from a table or graph to answer a question<br>○ Identify whether specific information is contained in graphic representations (e.g., table, graph, T-chart, diagram)<br>○ Identify a pattern/trend | ○ Categorize, classify materials, data, figures based on characteristics<br>○ Organize or order data<br>○ Compare/ contrast figures or data<br>○ Select appropriate graph and organize & display data<br>○ Interpret data from a simple graph<br>○ Extend a pattern | ○ Compare information within or across data sets or texts<br>○ Analyze and draw conclusions from data, citing evidence<br>○ Generalize a pattern<br>○ Interpret data from complex graph<br>○ Analyze similarities/differences between procedures or solutions | ○ Analyze multiple sources of evidence<br>○ Analyze complex/abstract themes<br>○ Gather, analyze, and evaluate information |
| **Evaluate**<br>Make judgments based on criteria, check, detect inconsistencies or fallacies, judge, critique | | | ○ Cite evidence and develop a logical argument for concepts or solutions<br>○ Describe, compare, and contrast solution methods<br>○ Verify reasonableness of results | ○ Gather, analyze, & evaluate information to draw conclusions<br>○ Apply understanding in a novel way, provide argument or justification for the application |
| **Create**<br>Reorganize elements into new patterns/structures, generate, hypothesize, design, plan, construct, produce | ○ Brainstorm ideas, concepts, or perspectives related to a topic | ○ Generate conjectures or hypotheses based on observations or prior knowledge and experience | ○ Synthesize information within one data set, source, or text<br>○ Formulate an original problem given a situation<br>○ Develop a scientific/mathematical model for a complex situation | ○ Synthesize information across multiple sources or texts<br>○ Design a mathematical model to inform and solve a practical or abstract situation |

# ITEM TYPES

The Wisconsin Forward Exam has multiple types of test items. However, because this item sampler is in a format that can be printed, the majority of its items are multiple-choice. In the Forward Exam, there will be a more diverse array of item types, including the ones described below.

## Selected-Response (SR) Items

Selected-Response (SR) items are an efficient method for measuring a broad range of content, and can be used to assess a variety of skills. Three types of SR items are used on the online assessments: Multiple-Choice (MC), Enhanced Selected-Response (ESR), and Evidence-Based Selected-Response (EBSR). In all cases, SR items require that a student determines the correct answer(s) to the item posed from a provided list. While it is still possible for a student to perform some work directly related to determining the correct answer, the student is not required to generate the content of the answer when responding to a Selected-Response item. An exception to this requirement is Mathematics Short-Response/Gridded-Response items where students will be required to enter a short alphanumeric response.

### Multiple-Choice (MC) Items

Multiple-Choice (MC) items on Wisconsin's assessments have four answer choices, including three distractors and one correct answer. Distractors for Mathematics represent common misconceptions, incorrect logic, incorrect application of an algorithm, computational errors, etc. Distractors for English Language Arts (ELA) are written to represent a common misinterpretation, predisposition, unsound reasoning, casual reading, etc. A correct response to an MC item is worth one raw point. The process skills, directives, and action statements within an MC item also specifically align with the Wisconsin Academic Standards. Multiple-Choice items are present in all grades and are used with all content areas.

Multiple-Choice items can be further defined by being linked to, or independent from, a stimulus source. Items that operate independent of a stimulus are also known as "stand-alone MC." Stand-alone items may still have tables, graphs, or other information used in support of the stem. English Language Arts uses a mixture of MC items linked to a stimulus passage and some that are stand-alone. For Mathematics, all MC items are considered stand-alone.

### Enhanced Selected-Response (ESR) Items

The Enhanced Selected-Response (ESR) items are multi-part autoscored items that may consist of varying combinations of Multiple-Choice, Multiple-Response, Gridded-Response, Completion or Short-Answer, and Technology-Enhanced items that explore in greater depth and cognitive complexity the knowledge, skills, and abilities specified by the standards of each content area. Typically, this item type has a common focus and explores authentic problem-solving skills. An example of a Statistics and Probability Mathematics ESR item would utilize a data-table stimulus with Part A using a Technology-Enhanced (TE) graphing tool to create a bar graph of the data presented and Part B asking students to calculate the mean of the data using a Short-Response item.

### Two-Part Evidence-Based Selected-Response (EBSR) Items

The Evidence-Based Selected-Response (EBSR) items have two parts and are designed to elicit a response based on what a student has read from a stimulus passage. EBSR items may be linked to a stimulus passage or to a stimulus passage set. There are several variations of two-part EBSR items, but all two-part EBSR items have an Accuracy piece and an Evidence piece.

The Accuracy piece of the item is Part A. Part A of a typical EBSR item will be similar to a standard MC test item. A student analyzes a passage and chooses a single, best (correct) answer from four answer choices. Part B of a typical EBSR item will elicit evidence from the stimulus passage and will require that the student selects one or more correct answers based on the response the student provided to Part A. Part B is also different from Part A in that it may have five or six answer options rather than just four answer options typical of an MC item and more than one option may be correct.

## Technology-Enhanced (TE) Items

Technology-Enhanced (TE) item types share the same functional structure as traditional paper and pencil test items; however, the expansive features and functions of a computer-based medium allow for the incorporation of technical enhancements into traditional elements of a test item, such as the item stem, the stimulus (if any), the response area, or a combination of all three. TE items are used in the content areas of ELA, Mathematics, and Science.

Item types such as drag-and-drop, hot spot, and in-line selection of multiple answers from drop-down menus broaden item presentation with engaging, interactive open-ended items.

A wide variety of TE item types will be present on the Wisconsin Forward Exam, including, but not limited to:

- **Clock Input**, where a student is able to add an hour hand and a minute hand to the clock;
- **Angle Draw Input**, where given a base line, the student can represent an angle;
- **Short Input**, where there are many types of short inputs that can be used (The number of characters is usually limited to a relatively small number in order to facilitate auto-scoring. The types of characters allowed can also be limited to text only, numbers only, or a mix. An equation editor can be utilized to assist the student in creating something as basic as a fraction or something more complex. The available symbols and templates in the equation builder can be customized for a testing program. Certain Short Input items can also be used in a paper-based test (PBT) as a Gridded-Response item.);
- **Bar Graph Input**, where students can produce bar graphs with prepopulated titles, labels, and scales, or the system can allow the student to populate them (The number of bars and the color of the bars is predetermined by the system. A reset feature is available that allows the student to start over from the original configuration.);
- **Number Line Input**, where students can create a graph that might involve plotting points only or points and lines (Both solid and open “dots” are available as well as line segments and rays. Number line graphs can have prepopulated titles, labels, and scales or can allow the student to populate them.);
- **Coordinate Graph Input**, which allows for the graphing and labeling of points and lines (Regions, determined by plotted lines, can be shaded. Solid and open “dots” as well as solid and dashed lines are available to the student. Coordinate graphs can have prepopulated titles, labels, and scales or can allow the student to populate them.);
- **Line Plot Input**, which is used as another way to graphically represent data (The basic structure is provided for the student. Certain labeling on the line plot can be done by the student. A reset feature is available that allows the student to start over from the original configuration.);
- **List Input**, a combination of the short input described earlier that allows the student to add input boxes (For example, it can be used for describing the steps in a process without revealing to the student the number of steps needed. The added input boxes can be rearranged and/or deleted.);
- **Drag-and-Drop Input**, a wide variety of ways are available to utilize a drag-and-drop input (The main difference between it and a drag-and-paste is that each dragable entity can be used only once with a drag-and-drop input. A reset feature is available that allows the student to start over from the original configuration.);

- **Drag-and-Paste Input**, a wide variety of ways are available to utilize drag-and-paste input (The main difference between it and a drag-and-drop is that each dragable entity can be used more than once with a drag-and-paste input. A reset feature is available that allows the student to start over from the original configuration.);
- **Drop-Down List Input**, allows for the creation of a situation where a great deal of information about a student's grasp of a concept can be determined with a single item (Students can be asked to choose from three function types, four number of real zero responses, and two inverse function responses. For one function alone, this provides 24 possible answer combinations. With the three functions, a considerable amount of information can be gained, making this almost an open-ended item type.);
- **Pictograph using Drag-and-Paste**, actually another example of drag-and-paste, but is worth mentioning on its own as it is a type of graphing often used at lower grade levels;
- **Circle Graph**, a graph that allows the student to create and label the "wedges" that represent the data (Circle graphs can have a prepopulated title or can allow the student to populate it. The color of the "wedges" is predetermined by the system.);
- **Matching**, allows for the use of text or graphics as the matching objects (The student clicks on one object and then clicks on a second object to connect them.);
- **Highlighting Text**, allows for designated text to be highlighted in a word, phrase, sentence, or paragraph; and the
- **Graphic Modification Hot Spot**, allows for one image to replace another image when a hot spot is clicked.

## Text-Dependent Analysis (TDA) Items

The English Language Arts (ELA) section of the Forward Exam presents students with a Text-Dependent Analysis (TDA) item. A TDA is a text-based analysis based on a single passage or a multiple passage set that each student has read during the assessment. The passage or passage set will consist of either literary or informational text. In order to successfully answer a TDA, students must analyze and use information from the passage(s) to plan a comprehensive, holistic response. Students will then write their response including supporting evidence from the passage(s). Students will have up to 5,000 characters to formulate their response. Students' responses are scored using a rubric that takes into account both the composition and the conventions of the student's writing.

The TDA portion of the Forward Exam requires students to read the text and then respond in writing in one of two ways:

- identifying and explaining a theme or central idea, using textual evidence to support the claim about what that theme or central idea is, or
- analyzing the development of an event, character, central ideas, or theme, using textual evidence to support the explanation and analysis.

TDA Item Samplers are available at https://dpi.wi.gov/assessment/forward/sample-items.

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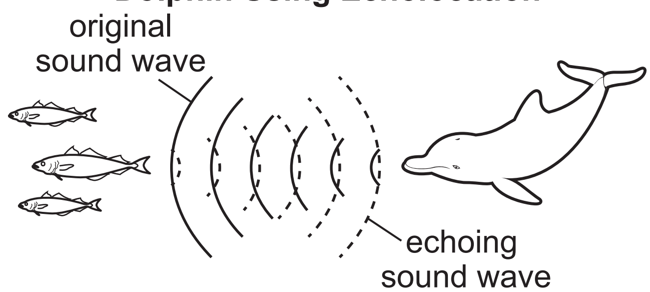
## SCENARIO 1

Read the following scenario. Then answer items 1 through 5. You may look back at the scenario to help you answer the items.

### Seeing with Sounds Underwater

It is difficult to see underwater where it is dark. Some ocean animals, such as dolphins, use sounds to help them understand their water environment. Dolphins produce high-pitched sounds. These sound waves travel through the water until they bump into an object. Then, the sound waves bounce off the object. The echoes of the sound waves return to the dolphin—specifically to the dolphin's jaw. The sounds travel through the dolphin's jaw to its inner ear, where the sounds are translated into nerve impulses that travel to the brain. The way dolphins "see" with sounds is called echolocation.

**Dolphin Using Echolocation**




From echoing sound waves, dolphins can learn a lot about an object: its shape, its size, its distance from the dolphin, and whether it is moving toward or away from the dolphin. Dolphins use echolocation to find their way around, to find prey, and to communicate with each other.

Scientists realized that the way dolphins can gather information from sounds could be used for human-made technology. Sonar is one example of this type of technology. Sonar is used by submarines and ships to find their way underwater and locate objects. Similar to echolocation, sonar sends out sound waves and interprets the echoing waves.

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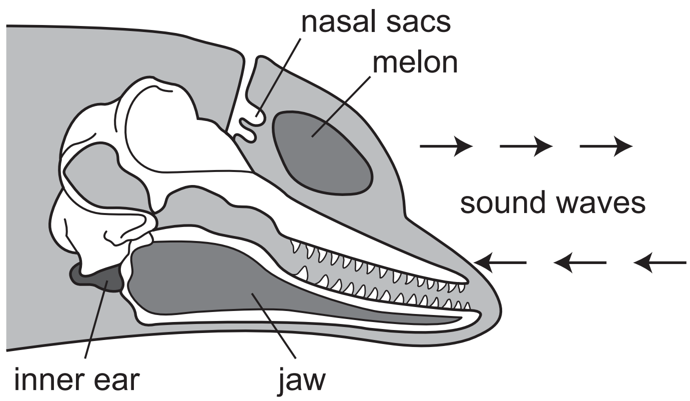
1. The diagram below shows how dolphins produce and receive sounds.

**Dolphin Echolocation System**




Dolphins make sounds by blowing air through their nasal sacs. These sounds travel into the water through the melon, an organ in the forehead. Returning sound waves are received through the jaw and then sent to the inner ear. In the inner ear, sound waves are translated into nerve impulses and sent to the brain.

Which model best shows how dolphins use incoming sound waves?

A. incoming sound waves → nerve impulses → jaw → inner ear → brain

B. incoming sound waves → jaw → inner ear → nerve impulses → brain

C. incoming sound waves → inner ear → nerve impulses → jaw → brain

D. incoming sound waves → nerve impulses → inner ear → jaw → brain

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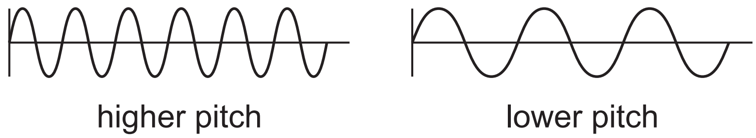
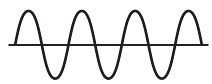
**2.** A student studies models of waves with different pitches.

**Sounds Produced by a Dolphin**

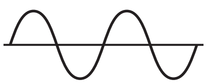


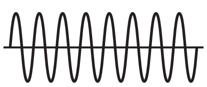

Echoing waves with a lower pitch than the original sound wave suggest the object is moving away from the source. A dolphin produces the sound wave shown below.

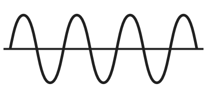
**Dolphin Sound Wave**

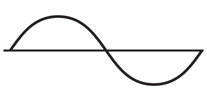


Which model <u>best</u> shows an echoing wave for an object moving <u>toward</u> the dolphin?

A. 

B. 

C. 

D. 

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**3.** Dolphins cannot detect fishing nets using echolocation. Sometimes dolphins get caught in these nets. A student listed two possible solutions to improve the design of the nets.

| **Possible Design Solutions** |
|---|
| Solution 1: increase the size of the openings in the net so dolphins can swim out<br><br>Solution 2: attach a device to the net that reflects echolocation sounds from dolphins |

The goals for the new nets are listed below.

**Goals for the Nets**

Goal A: prevent dolphins from getting trapped

Goal B: help dolphins to locate fishing nets

Which table best identifies the goal(s) that each solution meets?

A.

| | **Goal A** | **Goal B** |
|---|---|---|
| **Solution 1** | | × |
| **Solution 2** | × | |

B.

| | **Goal A** | **Goal B** |
|---|---|---|
| **Solution 1** | × | × |
| **Solution 2** | | × |

C.

| | **Goal A** | **Goal B** |
|---|---|---|
| **Solution 1** | × | |
| **Solution 2** | × | × |

D.

| | **Goal A** | **Goal B** |
|---|---|---|
| **Solution 1** | × | |
| **Solution 2** | | × |

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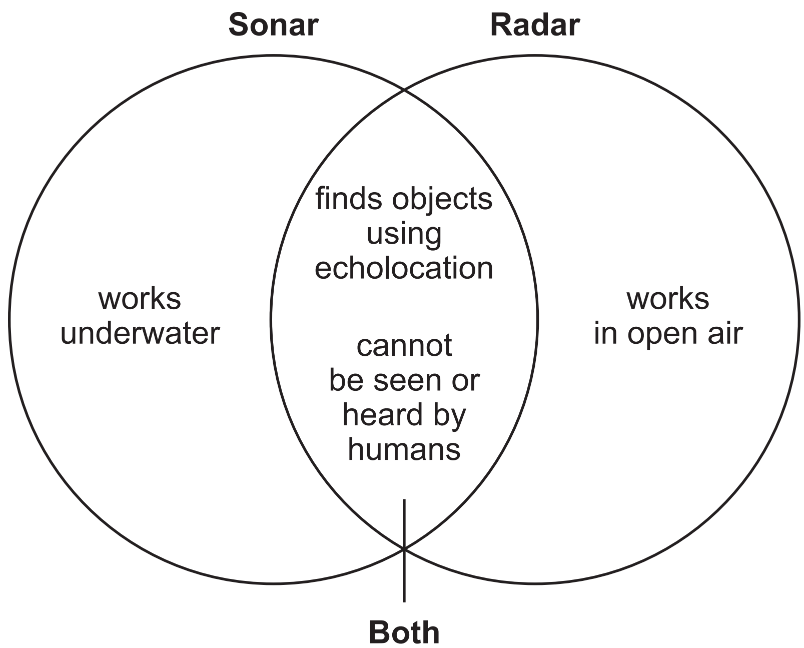
**4.** The Venn diagram below compares two applications of wave energy by humans.

1. sonar (sound navigation and ranging)
2. radar (radio detection and ranging)




A scientist wants to track the movement of songbirds as they migrate through Wisconsin.

Which explanation best describes the technology the scientist should use to track songbird migration?

A. The scientist should use radar to track songbird migration because it works in open air.

B. The scientist should use sonar to track songbird migration because it works in open air.

C. The scientist should use radar to track songbird migration because it works underwater.

D. The scientist should use sonar to track songbird migration because it works underwater.

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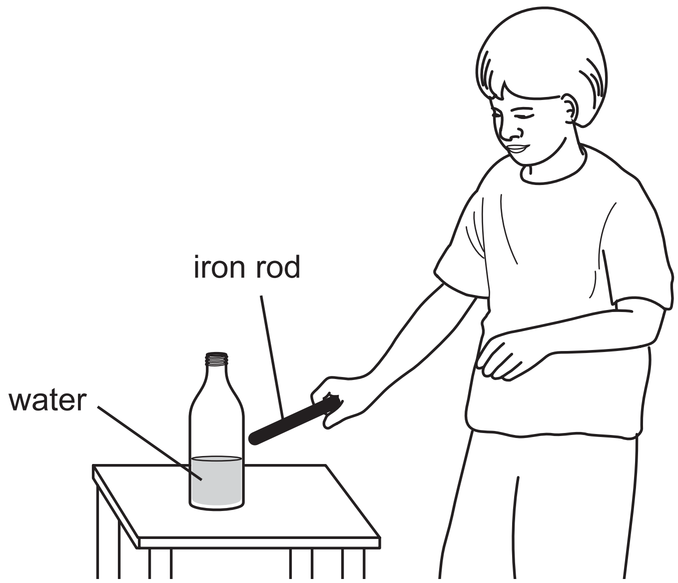
**5.** A student pours water into a glass bottle. Next, the student gently taps the outside of the bottle with an iron rod.




**Part A**

Which idea is most likely being investigated by the student?

A. energy transfer through materials

B. heat conduction through materials

C. magnetic properties of materials

D. reflective properties of materials

**Part B**

Which observations best support the answer to Part A?

A. The temperature of the water remains the same after the student taps the bottle with the iron rod.
The iron rod and the glass bottle are made of different materials.

B. A sound is produced when the student taps the bottle with the iron rod.
The temperature of the water remains the same after the student taps the bottle with the iron rod.

C. A sound is produced when the student taps the bottle with the iron rod.
Waves are produced in the water, showing vibration.

D. Waves are produced in the water, showing vibration.
The iron rod and the glass bottle are made of different materials.

**Go on to the next page.**

## SCENARIO 2

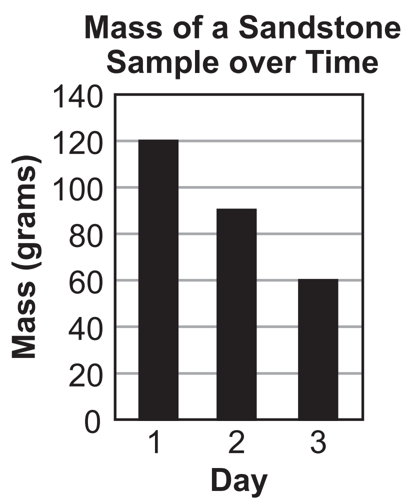
Read the following scenario. Then answer items 6 through 8. You may look back at the scenario to help you answer the items.

### Weathering Rocks

Students learn that igneous, sedimentary, and metamorphic rocks can be observed in Wisconsin. These rocks weather at different rates.

The students study data from an experiment that used a rock tumbler, which is a machine used to weather rocks. A rock tumbler spins and tumbles rocks similar to how a washing machine spins and tumbles clothes. A rock tumbler is filled with sand and water to help weather the rocks inside. The data from the experiment suggest that certain igneous rocks weather at a slower rate than some sedimentary and metamorphic rocks exposed to the same conditions.

The students decided to conduct a similar experiment with one type of rock in a rock tumbler half-filled with sand and water. The students selected a rock sample of sandstone, which is a sedimentary rock. Over three days, the students measured the mass of the sandstone. The students recorded the data in the graph below.

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**6.** The students decide to leave the rocks in the rock tumbler for a fourth day. One student claims that the mass of the sandstone sample on day 4 can be predicted since weathering conditions remained the same throughout the investigation.

What is the most likely mass of the sandstone sample on day 4 of the investigation?

A. 120 grams

B. 60 grams

C. 30 grams

D. 10 grams

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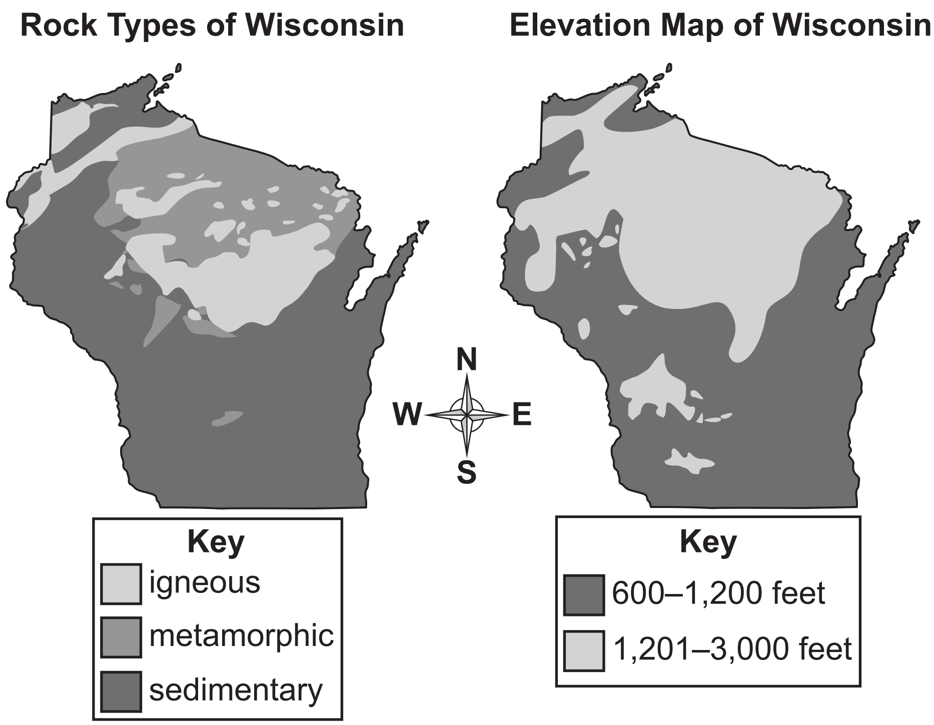
**7.** Students are studying characteristic rocks in Wisconsin. The students study two maps comparing the types of rocks in Wisconsin and the elevation across the state. One student observes a pattern between the rock type and elevation.




Which chart shows the pattern the student observed?

A.

| Elevation (feet) | Rock Types |
|---|---|
| 600–1,200 | metamorphic and sedimentary |
| 1,201–3,000 | igneous |

B.

| Elevation (feet) | Rock Types |
|---|---|
| 600–1,200 | sedimentary |
| 1,201–3,000 | igneous and metamorphic |

C.

| Elevation (feet) | Rock Types |
|---|---|
| 600–1,200 | igneous |
| 1,201–3,000 | metamorphic and sedimentary |

D.

| Elevation (feet) | Rock Types |
|---|---|
| 600–1,200 | igneous and metamorphic |
| 1,201–3,000 | sedimentary |

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**8.** Engineers are exploring locations to construct a new building. They study a chart showing factors that affect rates of weathering.

**Factors That Affect Rates of Weathering**

| **Factor** | weathering rate<br>fast ⟶ slow | | |
|---|---|---|---|
| precipitation | high | medium | low |
| thickness of soil layer | thin | medium | thick |
| hills | steep | medium | gentle |

Next, the engineers study a chart showing characteristics of four locations in Wisconsin.

| **Location** | **Average Yearly Precipitation (inches)** | **Thickness of Soil Layer** | **Hills** |
|---|---|---|---|
| 1 | 31–32 | thick | gentle |
| 2 | 37–38 | thin | gentle |
| 3 | 32–33 | medium | steep |
| 4 | 34–35 | thin | medium |

Which location most likely has the slowest rate of rock weathering?

A. location 1

B. location 2

C. location 3

D. location 4

**STOP.**


**STOP.**


**STOP.**

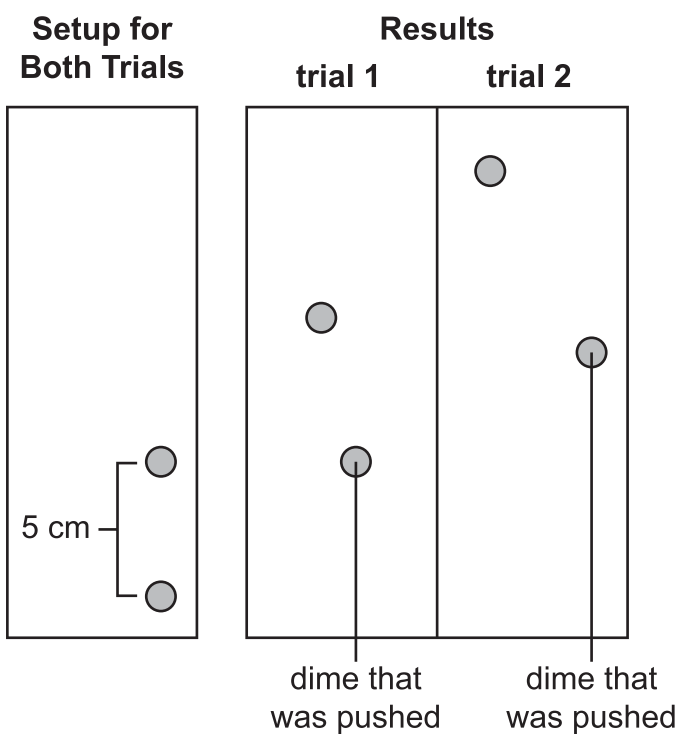
## SCENARIO 1

Read the following scenario. Then answer items 1 through 3. You may look back at the scenario to help you answer the items.

### Moving Dimes

Science students are using dimes to learn about energy transfer. The students set up four dimes on a smooth surface. A student pushed one dime into another dime placed 5 centimeters away—causing a collision.

In trial 1, the push was gentle. In trial 2, the push was stronger than in trial 1. The experimental setup and the results following the collision are shown below.

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**1.** A student suggests that there are several ways to observe energy transfer during a collision.

Which statement describes the best prediction about the results of this experiment if a student were collecting data about sound?

A. The collision in trial 1 would produce a sound that lasts for a longer time than the sound produced by the collision in trial 2.

B. The collisions in trial 1 and trial 2 would produce sounds that cannot be heard by the human ear.

C. The collisions in trial 1 and trial 2 would produce identical sounds.

D. The collision in trial 2 would produce a louder sound than the sound produced by the collision in trial 1.

**Go on to the next page.**

**2.** A student claims that the dime that was pushed in trial 2 had more energy than the dime that was pushed in trial 1.

Which explanation provides the best evidence from this investigation to support the claim?

A. The pushed dime in trial 2 had more energy because it moved forward in a straighter line than the pushed dime in trial 1.

B. The pushed dime in trial 2 had more energy because it received a gentler push than the dime in trial 1 did.

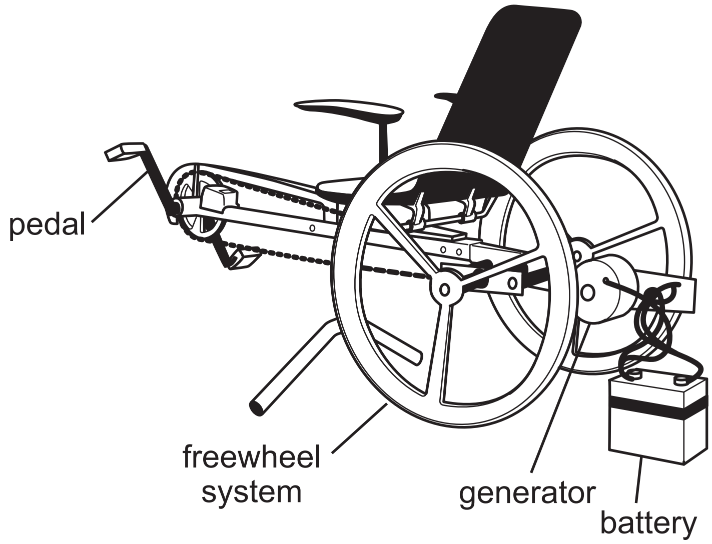
C. The pushed dime in trial 2 had more energy because it was pushed harder, and its faster motion caused the other dime to move farther after they collided than the pushed dime in trial 1 did.

D. The pushed dime in trial 2 had more energy because it moved more slowly than the pushed dime in trial 1 did, so it transferred more energy to the other dime when they collided.

**Go on to the next page.**

**3.** After observing the dimes collide, a student considers how energy transfer occurs in other objects. The student learns about a bike that is being used to provide electricity. The diagram below shows the bike.

**Electric Bike**




Next, the student studies the flowchart below about how the bike works.

pedal ⟶ freewheel system ⟶ generator ⟶ battery

Which option identifies an input and output in this system?

A. input: stored energy in the battery
output: motion energy in the body

B. input: motion energy in the body
output: stored energy in the battery

C. input: stored energy in the battery
output: sunlight energy

D. input: sunlight energy
output: motion energy in the body

**Go on to the next page.**

## STANDALONE ITEMS

**4.** Which words correctly complete the sentences to model how humans receive, understand, and react to information from a doorbell?

> 1. The person's _______ detect(s) the sound that the doorbell makes.
> 2. The information is interpreted in the person's _______ .
> 3. The person uses his or her _______ to move to the door.

A. 1. ears
2. brain
3. body

B. 1. ears
2. eyes
3. body

C. 1. body
2. brain
3. eyes

D. 1. brain
2. ears
3. eyes

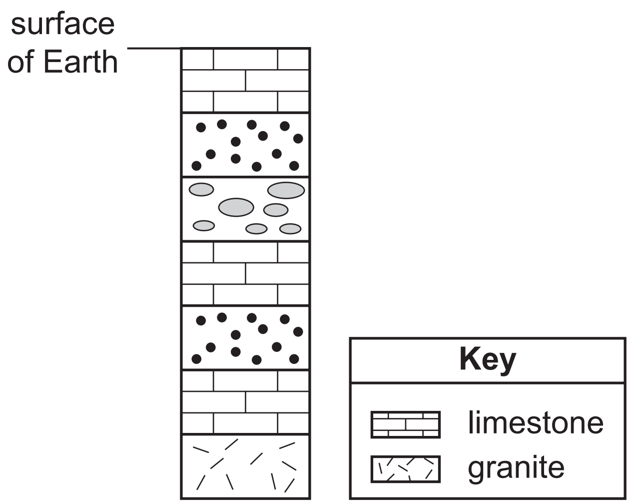
**Go on to the next page.**

**5.** A student is looking at the diagram below, which uses symbols to represent layers of rock in an area. Each type of rock has a unique symbol.

Limestone, a type of rock that is usually deposited when a surface is covered by an ocean, is shown by a brick-like pattern.

Granite, a rock that is commonly found in areas that have had volcanic eruptions, is shown by a pattern that looks like very short lines arranged in different directions.

**Rock Layer Symbols**




Which statements provide the best description of this area?

A. The deepest and oldest layer shows limestone, indicating that the land was formed by a volcano. The area was repeatedly affected by an ocean, as shown by the layers of granite.

B. The deepest and oldest layer shows limestone, indicating that the land was formed by an ocean. The area was repeatedly affected by a volcano, as shown by the layers of limestone.

C. The deepest and oldest layer shows granite, indicating that the land was formed by an ocean. The area was repeatedly affected by a volcano, as shown by the layers of granite.

D. The deepest and oldest layer shows granite, indicating that the land was formed by a volcano. The area was repeatedly affected by an ocean, as shown by the layers of limestone.

**STOP.**


**STOP.**

**STOP**

**STOP.**

## SUMMARY DATA

**Grade 4**

| Sample Number | Alignment | Answer Key | Depth of Knowledge | Annotations |
|---|---|---|---|---|
| **Session 1** | | | | |
| 1 | SCI.LS1.D.4: Disciplinary Core Idea;<br><br>SCI.SEP2.A.3-5: Developing Models;<br><br>SCI.CC4.3-5: Systems and System Models | B | 2 | A. The incoming sound waves move to the jaw before being sent as a nerve impulse.<br>B. Correct. The student is asked to model the process of dolphins receiving and processing incoming sounds.<br>C. The sound does not move directly to the inner ear when received and nerve impulses carry information to the brain, which is the last step of the system.<br>D. The incoming sound waves move to the jaw before being sent as a nerve impulse. |
| 2 | SCI.PS4.A.4: Disciplinary Core Idea;<br><br>SCI.SEP2.A.3-5: Developing Models;<br><br>SCI.CC1.3-5: Patterns | B | 2 | A. The wave model has a lower pitch than the dolphin sound wave, which means the object is moving away from the dolphin.<br>B. Correct. An object moving toward the dolphin will have a higher pitch (frequency) than an object moving away from the dolphin.<br>C. The wave model has the same pitch as the dolphin sound wave, which means the object is not moving.<br>D. The wave model has a lower pitch than the dolphin sound wave, which means the object is moving away from the dolphin. |

**Grade 4**

| Sample Number | Alignment | Answer Key | Depth of Knowledge | Annotations |
|---|---|---|---|---|
| 3 | SCI.ETS1.A.3-5: Disciplinary Core Idea;<br><br>SCI.SEP1.B.3-5: Defining Problems | C | 2 | A. Solution 1 will prevent dolphins from getting trapped but not help dolphins to locate fishing nets. Solution 2 will also help dolphins to locate fishing nets.<br>B. Solution 1 will not help dolphins to locate fishing nets. Solution 2 will also prevent dolphins from getting trapped.<br>C. Correct. Solution 1 can prevent dolphins from getting trapped. Solution 2 can help dolphins to locate fishing nets and hence also prevent dolphins from getting trapped.<br>D. Solution 2 will also prevent dolphins from getting trapped. |
| 4 | SCI.ETS1.A.3-5: Disciplinary Core Idea;<br><br>SCI.SEP6.A.3-5: Constructing Explanations | A | 3 | A. Correct. Radar would work best to track songbird migrations since birds fly in the open air and the Venn diagram shows that radar works in open air.<br>B. The Venn diagram shows that sonar works underwater but not in open air.<br>C. The Venn diagram shows that radar works in open air and not underwater.<br>D. The Venn diagram shows that sonar works underwater, but songbirds travel in open air and not underwater. Their migration would be better tracked by radar due to its ability to track in open air. |

**Grade 4**

| Sample Number | Alignment | Answer Key | Depth of Knowledge | Annotations |
|---|---|---|---|---|
| 5 | SCI.PS3.B.4: Disciplinary Core Idea;<br><br>SCI.SEP3.A.3-5: Planning and Conducting Investigations;<br><br>SCI.CC5.3-5: Energy and Matter | Part A: A<br><br>Part B: C | 3 | **Part A**<br><br>A. Correct. The student is investigating energy transfer from the iron rod through the bottle and water.<br>B. Although some heat energy will be transferred in the system, the student is not investigating heat conduction.<br>C. The student is not testing magnetic properties of materials.<br>D. The student is not testing reflective properties of materials.<br><br>**Part B**<br><br>A. Observations about temperature and the types of materials do not indicate that the student is investigating energy transfer through materials.<br>B. The observation about temperature does not indicate that the student is investigating energy transfer through materials.<br>C. Correct. Observations about sound and waves indicate that the student is investigating energy transfer through materials.<br>D. The observation about the types of materials does not indicate that the student is investigating energy transfer through materials. |

**Grade 4**

| Sample Number | Alignment | Answer Key | Depth of Knowledge | Annotations |
|---|---|---|---|---|
| 6 | SCI.ESS2.A.4: Disciplinary Core Idea;<br><br>SCI.SEP4.A.3-5: Analyze and Interpret Data;<br><br>SCI.CC2.3-5: Cause and Effect | C | 2 | A. The mass of the rock sample on day 4 will be less than the mass of the rock sample on day 1.<br>B. The mass of the rock sample on day 4 will be less than the mass of the rock sample on day 3.<br>C. Correct. Based on the pattern shown in the graph, the mass of the rock sample on day 4 will be about 30 grams less than the mass of the rock sample on day 3.<br>D. The mass of the rock sample on day 4 will more likely be about 30 grams less than the mass of the rock sample on day 3. |
| 7 | SCI.ESS2.B.4: Disciplinary Core Idea;<br><br>SCI.SEP4.A.3-5: Analyze and Interpret Data;<br><br>SCI.CC1.3-5: Patterns | B | 3 | A. The maps indicate that metamorphic rocks are mostly found at higher elevations.<br>B. Correct. The maps indicate that lower elevations have mostly sedimentary rocks and higher elevations have mostly igneous and metamorphic rocks.<br>C. The chart shows the reverse of the trend from the maps for igneous and sedimentary rocks.<br>D. The maps indicate the opposite pattern to what is shown in the chart. |
| 8 | SCI.ESS3.B.4: Disciplinary Core Idea;<br><br>SCI.SEP6.B.3-5: Design Solutions;<br><br>SCI.CC2.3-5: Cause and Effect | A | 3 | A. Correct. Location 1 most likely has the slowest rate of rock weathering due to the relatively low yearly precipitation, the thick soil layer, and the gentle slopes.<br>B. The higher amount of yearly precipitation and the thin soil layer indicate that location 2 likely does not have the slowest rate of rock weathering.<br>C. The steep hills indicate that location 3 likely does not have the slowest rate of rock weathering.<br>D. The thin soil layer indicates that location 4 likely does not have the slowest rate of rock weathering. |

**Grade 4**

| Sample Number | Alignment | Answer Key | Depth of Knowledge | Annotations |
|---|---|---|---|---|
| **Session 2** | | | | |
| 1 | SCI.PS3.C.4: Disciplinary Core Idea;<br><br>SEP3.A.3-5: Planning and Conducting Investigations;<br><br>SCI.CC5.3-5: Energy and Matter | D | 3 | A. There is no evidence that the collision in trial 1 would produce a sound that lasted longer than the collision in trial 2.<br>B. There is no evidence that the collisions would produce sounds that cannot be heard by the human ear; the student is collecting data about sound.<br>C. The collision in trial 2 would produce a slightly louder sound than, not an identical sound to, the collision in trial 1.<br>D. Correct. The collision in trial 2 would produce a slightly louder sound; the dime in trial 2 was pushed harder, which means it transferred more energy to the other dime. |
| 2 | SCI.PS3.A.4: Disciplinary Core Idea;<br><br>SCI.SEP6.A.3-5: Constructing Explanations;<br><br>SCI.CC5.3-5: Energy and Matter | C | 2 | A. Moving in a straighter line does not indicate that the dime had more energy.<br>B. The pushed dime in trial 2 received a stronger push than the pushed dime in trial 1.<br>C. Correct. The harder push in trial 2 means that the pushed dime had more energy of motion that was transferred to the other dime, causing it to move farther.<br>D. The pushed dime in trial 2 received a stronger push, so it moved faster than the pushed dime in trial 1. |
| 3 | SCI.PS3.B.4: Disciplinary Core Idea;<br><br>SCI.CC5.3-5: Energy and Matter | B | 2 | A. This is the reverse of the input and output for the system.<br>B. Correct. Motion energy from the body is the input into the bike system, and it is transferred to stored energy in the battery.<br>C. Stored energy in the battery is the output in the system, and the bike system output is not sunlight energy.<br>D. Motion energy from the body is the input into the bike system, not the output; and the input is motion energy from the body, not sunlight energy. |

**Grade 4**

| Sample Number | Alignment | Answer Key | Depth of Knowledge | Annotations |
|---|---|---|---|---|
| 4 | SCI.LS1.D.4: Disciplinary Core Idea;<br><br>SCI.CC4.3-5: Systems and System Models | A | 2 | A. Correct. The ears detect the doorbell's sound, the brain interprets the sound, and then the person's body moves toward the door.<br>B. The brain, not the eyes, interprets the sound from the doorbell.<br>C. The ears, not the body, detect the doorbell's sound, and the person uses the body, not the eyes, to move to the door.<br>D. The ears, not the brain, detect the doorbell's sound; the brain, not the ears, interprets the sound from the doorbell; and the person uses the body, not the eyes, to move to the door. |
| 5 | SCI.ESS1.C.4: Disciplinary Core Idea;<br><br>SCI.SEP6.A.3-5: Constructing Explanations;<br><br>SCI.CC1.3-5: Patterns | D | 3 | A. The student reverses the symbols for limestone and granite.<br>B. The student reverses the symbols for limestone and granite and also what is indicated by the presence of limestone and granite rock layers.<br>C. The student reverses what is indicated by the presence of limestone and granite rock layers.<br>D. Correct. The student is asked to interpret the symbols for the granite and limestone rock layers and to identify what is indicated by their presence. |

# Science
# Item Sampler
# Grade 4