



8



RELEASED SCIENCE ITEMS

This book contains the released Trends in International Mathematics and Science Study (TIMSS) 2011 grade 8 science assessment items. This is not a complete set of all TIMSS 2011 assessment items because some items are kept confidential so that they may be used in subsequent cycles of TIMSS to measure trends.

How Can This Set of Released Items Be Used?

In Teacher-designed Assessments. The items in this book present different ways of measuring students' understanding in various content and cognitive domains. A teacher may use these items to create an assessment according to the needs of the class after reviewing the items and selecting items of interest.

For Feedback on Student Understanding. Student responses can be scored according to the scoring information provided in the book. Items that coincide with concepts taught in class allow the teacher to gain feedback on the students' understanding of assessed concepts. For example, a teacher might decide to examine the incorrect or partially correct responses of the class. The teacher might use the items to identify particular difficulties or misconceptions experienced by individual students, which can serve as the basis for some remedial teaching or focused practice.

To Benchmark Student Performance. The teacher might also compare the percent of students in the class who responded correctly to an item with the percent of students who responded correctly to the same item in other education systems or in the United States.

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USER'S GUIDE

Grade 8

This book contains TIMSS 2011 released items for grade 8. Each item appears on a single page, on which is provided information about the item's classification and about international student performance on the item. The items appear in the content domain order, as shown in the index on the next page.

Information about item classification

Take a look at the first item on page 1. Across the top are three boxes which identify the item's **content domain** (the subject matter in science that the item assesses), its **main topic** (the specific topic assessed within that subject matter), and its **cognitive domain** (the cognitive or thinking process assessed). For this item, the content domain is biology, the main topic is characteristics, classification and life processes of organisms, and the cognitive domain is knowing.

Below the row of boxes and above a boxed-in area of the page is the **item label**. For this item, it is *One function of the uterus*. Below the boxed-in area is the item number, which is more commonly used to identify each item than the item label. Within the boxed-in area is the item as it appeared in student test booklets.

Correct answers are shown beneath each item. The correct answer for multiple-choice items is simply a letter code. For example, in the item *S032087* on page 3, the letter code C is the correct answer. The correct answers for write-in or open-ended items are explained in a scoring guide. For example, *One function of the uterus* (page 1), provides an example of a scoring guide, indicating the general nature of correct and incorrect

responses. In some cases, partial credit may be awarded and these items will provide guidelines for fully correct, partially correct, and incorrect responses. Sample student responses are provided for some of the constructed-response items for each scoring category.

Information about international student performance

In the table along the right-hand side of the page are the **percent correct** statistics for the item. These consist of statistics on the percentage of students in each education system who could answer the question correctly. The lists of education systems are ordered in terms of this percentage. The international average is included as well.

To the right of some of the percent correct statistics are **special symbols** that indicate when an education system scored significantly higher or significantly lower than the international average. Thus, on the item *One function of the uterus* as an example, an estimated 46 percent of U.S. students could correctly answer this item; a percentage that was measurably higher than the international average, after taking into account the standard of error associated with the percent correct statistic for the United States and for the international average.



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Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Characteristics, Classification, and Life Processes of Organisms	Knowing

One function of the uterus

The uterus (womb) is part of the reproductive system in mammals.
Name one function of the uterus.

Item Number: S032007

SCORING

Correct Response

- States that the embryo (fetus, baby, fertilized egg, etc.) develops in the uterus (or similar).

Examples:

The uterus protects the baby while it grows.

The baby develops from the egg inside the uterus.

- Other correct

Example: The muscles in the uterus contract and push the baby out.

Incorrect Response

- States a reproductive organ or function but with an incorrect/inadequate connection to the function of the uterus.

- Confuses the reproductive and urinary systems.

- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	72
Finland	64
Israel	63
Syrian Arab Republic	60
Slovenia	59
England-GBR	58
Korea, Rep. of	57
Chinese Taipei-CHN	54
Saudi Arabia	53
Australia	52
Russian Federation	51
Lithuania	50
Kazakhstan	50
Japan	49
Iran, Islamic Rep.	47
United States	46
New Zealand	46
United Arab Emirates	46
Sweden	45
Hong Kong-CHN	44
Jordan	42
Palestinian Nat'l Auth.	42
International average	40
Chile	39
Norway	39
Bahrain	39
Ukraine	37
Macedonia, Rep. of	37
Italy	37
Ghana	31
Georgia	31
Oman	28
Qatar	28
Hungary	27
Indonesia	26
Turkey	25
Romania	24
Tunisia	23
Morocco	21
Thailand	20
Lebanon	17
Malaysia	11
Armenia	3

Benchmarking education system

Minnesota-USA	65
Massachusetts-USA	58
Alberta-CAN	55
Connecticut-USA	53
Indiana-USA	53
Colorado-USA	49
Quebec-CAN	48
North Carolina-USA	44
Dubai-UAE	44
Florida-USA	43
Ontario-CAN	41
Abu Dhabi-UAE	39
California-USA	38
Alabama-USA	33

Percent higher than International average
 Percent lower than International average

One function of the uterus (continued)

S032007:

Student Responses

Correct Response:

To hold the child while it's
developing

Incorrect Response:

giving birth

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Human Health	Knowing

Long-term immunity against disease

Which of the following can provide the human body with long-term immunity against some diseases?

- A. antibiotics
- B. vitamins
- C. vaccines
- D. red blood cells

Item Number: S032087

Correct Response:	C
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Overall Percent Correct

Education system	Percent correct
Finland	81
Sweden	75
Italy	74
Syrian Arab Republic	65
England-GBR	64
Iran, Islamic Rep. of	62
Turkey	61
Tunisia	59
Norway	57
Singapore	56
United States	56
Australia	55
Russian Federation	55
Israel	53
Japan	53
Thailand	50
New Zealand	49
Hong Kong-CHN	49
Slovenia	48
Macedonia, Rep. of	48
Chinese Taipei-CHN	47
Lebanon	47
Bahrain	46
International average	45
United Arab Emirates	45
Chile	43
Georgia	39
Qatar	37
Armenia	36
Morocco	36
Hungary	34
Romania	32
Kazakhstan	31
Palestinian Nat'l Auth.	31
Ukraine	30
Saudi Arabia	28
Jordan	24
Lithuania	23
Oman	20
Malaysia	15
Indonesia	11
Ghana	8
Korea, Rep. of	—

Benchmarking education system

Massachusetts-USA	71
Indiana-USA	66
Minnesota-USA	65
North Carolina-USA	64
Alberta-CAN	57
Colorado-USA	56
Florida-USA	56
Connecticut-USA	54
Quebec-CAN	54
Dubai-UAE	51
Ontario-CAN	50
California-USA	48
Abu Dhabi-UAE	43
Alabama-USA	43

Percent higher than International average

Percent lower than International average

— Not applicable

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Characteristics, Classification, and Life Processes of Organisms	Applying

Eyes react to changes

Diagram 1

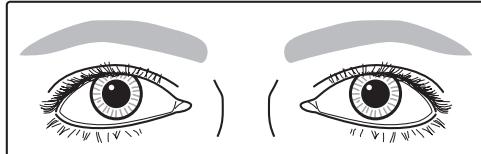
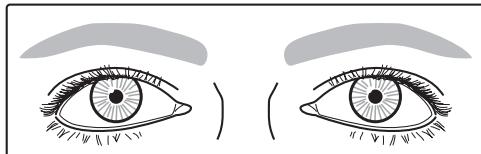


Diagram 2



Diagrams 1 and 2 illustrate the same pair of eyes that have reacted to a change in an environmental condition.

What is the environmental condition and how is it different for the eyes in Diagram 1 and Diagram 2?

Item Number: S032306

SCORING

Correct Response

- Indicates LIGHT and identifies which diagram corresponds to the low/high light level.

Diagram 1 = dim light, low light level, darkness, or similar

Diagram 2 = bright light, high light level, or similar

Example: There is less light in Diagram 1. The pupil has gotten larger to let in more light.

- Other fully correct

Partially Correct Response

- Indicates LIGHT but does not identify which diagram corresponds to low/high light level.

Example: It is the light level. In Diagram 1, the pupils are bigger. In diagram 2 they are smaller.

- Other partially correct

Incorrect Response

- Indicates LIGHT but reverses the conditions in Diagrams 1 and 2.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	74
Finland	65
Sweden	63
Hungary	59
Russian Federation	54
Lithuania	52
Slovenia	49
New Zealand	48
Norway	48
Australia	48
Italy	48
United States	47
England-GBR	46
Japan	45
Hong Kong-CHN	43
Chinese Taipei-CHN	37
Ukraine	35
Turkey	33
Israel	33
International average	31
Romania	28
Iran, Islamic Rep. of	27
Singapore	26
Malaysia	22
Kazakhstan	21
Palestinian Nat'l Auth.	21
United Arab Emirates	21
Bahrain	19
Macedonia, Rep. of	19
Armenia	18
Thailand	18
Chile	18
Tunisia	17
Georgia	17
Qatar	16
Syrian Arab Republic	16
Lebanon	13
Oman	13
Jordan	10
Saudi Arabia	7
Indonesia	6
Morocco	3
Ghana	2

Benchmarking education system

Alberta-CAN	58
Minnesota-USA	57
Massachusetts-USA	56
Colorado-USA	52
Connecticut-USA	51
Indiana-USA	47
North Carolina-USA	46
Florida-USA	45
Quebec-CAN	43
Ontario-CAN	41
Alabama-USA	37
California-USA	37
Dubai-UAE	33
Abu Dhabi-UAE	17

Percent higher than International average
 Percent lower than International average

Eyes react to changes (continued)

S032306:

Student Responses

Correct Response:

In diagram 1 the pupils are dilated meaning it must be dark outside

Partially Correct Response:

The environmental condition is the sun. If you stay in the sun a lot there will be some changes on your body including your eyes.

Eyes react to changes (continued)

S032306:

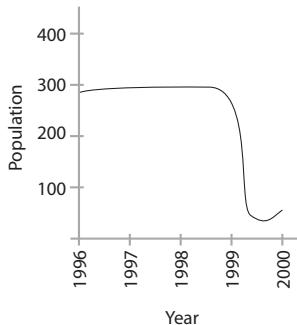
Student Responses

Incorrect Response:

diagram one would be in the sun
Or outside with sunlight while
diagram 2 is when you've
been in the dark and turned
on the lights

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Ecosystems	Reasoning

Antelope population graph



The graph indicates the number of antelopes in a certain area over a period of time. Which of the following factors is most likely to have caused the sudden change in population between 1999 and 2000?

- A. global warming
- B. absence of predators
- C. depletion of the ozone layer
- D. brush fires that destroyed the food supply

Item Number: S032315

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Russian Federation	75
Ukraine	69
Singapore	68
Finland	64
Malaysia	64
Israel	63
Hungary	63
England-GBR	62
Lithuania	61
Slovenia	61
United States	58
Tunisia	57
Chinese Taipei-CHN	54
New Zealand	54
Kazakhstan	54
Australia	53
Iran, Islamic Rep. of	51
Thailand	51
International average	48
Indonesia	47
Chile	46
Georgia	44
United Arab Emirates	44
Bahrain	44
Romania	44
Norway	43
Sweden	42
Italy	42
Hong Kong-CHN	42
Saudi Arabia	41
Jordan	40
Turkey	39
Armenia	39
Morocco	39
Syrian Arab Republic	37
Japan	37
Macedonia, Rep. of	35
Qatar	35
Oman	35
Korea, Rep. of	32
Ghana	32
Palestinian Nat'l Auth.	31
Lebanon	18

Benchmarking education system

Massachusetts-USA	66
Minnesota-USA	65
Colorado-USA	64
Indiana-USA	62
Alberta-CAN	61
Florida-USA	59
North Carolina-USA	58
Connecticut-USA	54
California-USA	50
Quebec-CAN	48
Alabama-USA	45
Abu Dhabi-UAE	45
Dubai-UAE	42
Ontario-CAN	42

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Diversity, Adaptation, and Natural Selection	Applying

Difference in snail shell colors

Some birds eat snails. A species of snail that lives in the forest has a dark shell. The same species of snail that lives in a field has a light-colored shell. Explain how this difference in shell colors helps the snails to survive.

Item Number: S032451

SCORING

Correct Response

- Explanation refers explicitly to BOTH camouflage (blending in with surroundings, or similar) AND protection from birds, predators, enemies, etc.

Example: The snails that live in the forest have dark shells so the birds cannot see them to eat them.

- Explanation refers only to camouflage, blending in with surroundings, or similar. [Protection from predators NOT explicitly mentioned.]

Example: It helps the snail to camouflage with their surroundings.

- Other fully correct

Partially Correct Response

- Explanation refers only to not being eaten or seen by predators. [Camouflage NOT referenced.]

Example: So the birds will not eat them.

- Other partially correct

Incorrect Response

- Mentions only that it is dark in the forest and light in the field. [Does not explicitly refer to camouflage, protection from predators, or similar.]
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Hungary	79
Finland	79
Russian Federation	76
England-GBR	76
Singapore	74
Ukraine	73
Australia	73
United States	71
Sweden	66
Japan	65
Korea, Rep. of	65
New Zealand	65
Chinese Taipei-CHN	62
Slovenia	61
Hong Kong-CHN	61
Lithuania	60
Norway	60
Israel	57
Thailand	57
Italy	56
Kazakhstan	52
Turkey	50
International average	45
Georgia	40
Romania	40
Iran, Islamic Rep. of	39
Chile	37
United Arab Emirates	28
Armenia	28
Oman	27
Syrian Arab Republic	26
Bahrain	24
Qatar	22
Jordan	21
Tunisia	20
Macedonia, Rep. of	19
Indonesia	16
Lebanon	15
Malaysia	15
Saudi Arabia	12
Palestinian Nat'l Auth.	11
Morocco	3
Ghana	2

Benchmarking education system

Colorado-USA	79
Massachusetts-USA	78
Minnesota-USA	77
Connecticut-USA	76
Alberta-CAN	75
Ontario-CAN	74
Indiana-USA	74
North Carolina-USA	69
Florida-USA	66
Quebec-CAN	65
California-USA	64
Alabama-USA	63
Dubai-UAE	42
Abu Dhabi-UAE	26

Percent higher than International average

Percent lower than International average

Difference in snail shell colors (continued)

S032451:

Student Responses

Correct Response:

The snails are usual on grass or sand. They have to match it so that the birds will mistake it for being something else.

Partially Correct Response:

Snails use there shells color to hide from predators

Incorrect Response:

Because , one stays in sun , one stays in shade

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Human Health	Knowing

Cells that destroy bacteria

Bacteria that enter the body are destroyed by which type of cells?

- A. white blood cells
- B. red blood cells
- C. kidney cells
- D. lung cells

Item Number: S032465

Correct Response:	A
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Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	86
Singapore	84
Korea, Rep. of	80
Italy	78
Japan	77
United States	76
Sweden	74
Thailand	73
England-GBR	71
Iran, Islamic Rep. of	71
Australia	70
Israel	70
Lithuania	68
Lebanon	68
Tunisia	68
Finland	68
Saudi Arabia	67
Kazakhstan	67
Hong Kong-CHN	66
Indonesia	66
Hungary	64
New Zealand	62
International average	61
Romania	60
Macedonia, Rep. of	60
Syrian Arab Republic	60
Russian Federation	59
Qatar	59
Bahrain	58
United Arab Emirates	57
Armenia	55
Malaysia	54
Norway	54
Palestinian Nat'l Auth.	52
Chile	48
Jordan	48
Oman	43
Ukraine	42
Ghana	40
Turkey	37
Georgia	35
Morocco	31
Slovenia	30

Benchmarking education system

Indiana-USA	85
Minnesota-USA	84
Massachusetts-USA	79
Connecticut-USA	79
North Carolina-USA	79
Florida-USA	78
Alberta-CAN	77
Ontario-CAN	77
Colorado-USA	76
Alabama-USA	74
Dubai-UAE	70
California-USA	69
Quebec-CAN	60
Abu Dhabi-UAE	56

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Ecosystems	Applying

Growth of algae in a lake

In a lake near a farm the growth of algae suddenly increased. This increase was most likely due to which of the following?

- A. a decrease in air temperature
- B. a decrease in water level
- C. fertilizer runoff from the farm
- D. exhaust gases from farm equipment

Item Number: S032514

Correct Response:	C
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Overall Percent Correct

Education system	Percent correct
Finland	74
Chinese Taipei-CHN	67
Georgia	65
Slovenia	64
Hong Kong-CHN	61
Romania	60
Sweden	59
Japan	59
Israel	57
Ukraine	56
Kazakhstan	55
Thailand	54
Russian Federation	52
Norway	52
Singapore	52
Lithuania	50
Hungary	50
Jordan	49
Korea, Rep. of	49
United States	48
International average	47
Italy	47
Chile	47
Malaysia	46
Tunisia	46
Macedonia, Rep. of	45
Turkey	43
Indonesia	43
Oman	41
New Zealand	40
England-GBR	40
Syrian Arab Republic	40
Saudi Arabia	39
United Arab Emirates	39
Palestinian Nat'l Auth.	39
Bahrain	36
Qatar	36
Armenia	35
Iran, Islamic Rep. of	35
Australia	34
Morocco	31
Ghana	30
Lebanon	27

Benchmarking education system

North Carolina-USA	72
Minnesota-USA	63
Quebec-CAN	60
Massachusetts-USA	57
Florida-USA	57
Connecticut-USA	53
Indiana-USA	53
Colorado-USA	51
Alberta-CAN	48
Dubai-UAE	40
Ontario-CAN	39
Alabama-USA	39
California-USA	38
Abu Dhabi-UAE	36

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Life Cycles, Reproduction, and Heredity	Knowing

Conditions for germination-DERIVED

Many seeds can germinate in the light or in the dark.
State two conditions necessary for germination.

1.

2.

Item Number: S032530Z

SCORING

Note: Each of the two responses are scored separately. However, if the two responses are essentially the same, the second response should be scored as "Incorrect Response".

Correct Response

- Water (moisture, rain) or similar.

Example: Humid conditions

- Suitable temperature (heat, warmth) or similar.

Example: Heat about 27° C

- Oxygen (air).
- Other correct

Incorrect Response

- Soil or similar.
- Sun, sunlight, or light (no explicit mention of heat, warmth or similar).
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	55
Kazakhstan	46
Japan	40
Russian Federation	38
Lithuania	36
Ukraine	32
Slovenia	32
Tunisia	29
England-GBR	26
Hong Kong-CHN	26
Korea, Rep. of	26
Georgia	25
Romania	23
Armenia	23
Macedonia, Rep. of	23
Israel	22
Bahrain	21
Chinese Taipei-CHN	21
International average	21
Turkey	20
Ghana	20
Finland	20
New Zealand	20
Sweden	18
Norway	17
Hungary	16
United Arab Emirates	15
Syrian Arab Republic	14
Malaysia	14
Chile	13
Jordan	13
Iran, Islamic Rep. of	13
Morocco	13
Qatar	12
Saudi Arabia	11
Australia	11
United States	11
Palestinian Nat'l Auth.	11
Lebanon	10
Italy	10
Thailand	7
Oman	7
Indonesia	4

Benchmarking education system

Dubai-UAE	20
Quebec-CAN	18
Alberta-CAN	15
Connecticut-USA	15
Abu Dhabi-UAE	15
Massachusetts-USA	15
Indiana-USA	13
Colorado-USA	13
Minnesota-USA	12
California-USA	11
North Carolina-USA	11
Alabama-USA	11
Ontario-CAN	10
Florida-USA	8

Percent higher than International average
 Percent lower than International average

Conditions for germination (continued)

S032530Z:

Student Responses

Correct Response:

1. water

2. air

Incorrect Response:

1. underground germs

2. surface germs

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Characteristics, Classification, and Life Processes of Organisms	Applying

Classification of animals

The following table shows the classification of some animals into two categories.

Category 1	Category 2
rabbit	frog
giraffe	spider
elephant	lion

Which of the following was used to classify these animals?

- A. organs used in breathing
- B. food source
- C. method of reproduction
- D. pattern of movement

Item Number: S032542

Correct Response:	B
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Overall Percent Correct

Education system	Percent correct
Singapore	76
Chinese Taipei-CHN	73
Finland	71
Japan	70
Korea, Rep. of	68
Slovenia	68
Hungary	67
Russian Federation	64
Hong Kong-CHN	59
Italy	58
Israel	54
Sweden	53
Turkey	52
Lithuania	52
Thailand	52
Tunisia	51
Ukraine	51
Norway	51
Australia	50
International average	49
Chile	49
Syrian Arab Republic	49
New Zealand	49
United States	45
Malaysia	45
England-GBR	45
Qatar	45
Lebanon	45
Bahrain	44
Romania	43
Morocco	43
United Arab Emirates	42
Palestinian Nat'l Auth.	41
Oman	40
Macedonia, Rep. of	37
Iran, Islamic Rep. of	37
Kazakhstan	36
Saudi Arabia	36
Jordan	36
Indonesia	34
Armenia	33
Georgia	31
Ghana	28

Benchmarking education system

Massachusetts-USA	57
Alberta-CAN	55
Quebec-CAN	52
Colorado-USA	50
Minnesota-USA	48
Florida-USA	46
Connecticut-USA	46
Dubai-UAE	45
Ontario-CAN	44
California-USA	41
Abu Dhabi-UAE	41
North Carolina-USA	40
Indiana-USA	38
Alabama-USA	36

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Cells and Their Functions	Knowing

Purpose of cellular respiration

Which of the following best describes the purpose of cellular respiration?

- A. to provide energy for cell activities
- B. to produce sugar for storage in cells
- C. to release oxygen for breathing
- D. to supply carbon dioxide for photosynthesis

Item Number: S032611

Correct Response:	A
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Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	66
Russian Federation	62
Singapore	58
Japan	56
Israel	48
Chinese Taipei-CHN	47
Turkey	46
Hong Kong-CHN	45
Lithuania	43
Italy	42
United Arab Emirates	40
Australia	39
Slovenia	38
Saudi Arabia	37
Macedonia, Rep. of	36
Ukraine	36
England-GBR	35
International average	35
Chile	35
Malaysia	34
Ghana	34
Norway	34
Tunisia	33
Qatar	33
Sweden	33
Oman	32
Lebanon	32
Iran, Islamic Rep. of	32
Indonesia	31
Bahrain	31
Finland	30
United States	30
New Zealand	29
Palestinian Nat'l Auth.	26
Armenia	24
Morocco	24
Syrian Arab Republic	23
Romania	23
Hungary	23
Georgia	21
Kazakhstan	20
Thailand	19
Jordan	17

Benchmarking education system

North Carolina-USA	43
Dubai-UAE	43
Abu Dhabi-UAE	41
Massachusetts-USA	41
Minnesota-USA	39
Connecticut-USA	36
Colorado-USA	34
California-USA	34
Ontario-CAN	33
Indiana-USA	33
Alabama-USA	31
Alberta-CAN	31
Florida-USA	30
Quebec-CAN	26

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Life Cycles, Reproduction, and Heredity	Applying

Number of kidneys son has at birth

Kidneys are organs found in the human body. When he was young, a man had one of his two kidneys removed because it was diseased. He now has a son.

- A. How many kidneys did his son have at birth? _____
- B. Explain your answer.

Item Number: S032614

SCORING

Correct Response

- TWO with an explanation based on the removal of a kidney not being a hereditary trait (or similar).

Examples:

Removal of his kidney is not in his genes, so it will not be passed on.

It's not hereditary.

- TWO with an explanation based on all humans (normally) having two kidneys at birth (or similar). [No explicit mention of heredity.]

Examples:

Everybody is born with two kidneys unless they have a disease.

His child would still have the normal number, which is 2.

- Other correct

Incorrect Response

- ONE with or without explanation.
- TWO with no explanation or an incorrect explanation.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	75
Singapore	75
United States	75
Chinese Taipei-CHN	72
Slovenia	71
Finland	71
Hungary	70
Sweden	68
Japan	67
Russian Federation	67
Kazakhstan	67
Hong Kong-CHN	66
Australia	65
England-GBR	65
Israel	64
Lithuania	64
New Zealand	63
Norway	60
Italy	60
Chile	59
Ukraine	57
Iran, Islamic Rep. of	56
Romania	56
Turkey	54
International average	53
Jordan	53
Saudi Arabia	51
Thailand	49
Armenia	45
United Arab Emirates	41
Palestinian Nat'l Auth.	40
Bahrain	40
Tunisia	40
Georgia	39
Indonesia	39
Syrian Arab Republic	36
Macedonia, Rep. of	34
Qatar	32
Oman	32
Malaysia	30
Lebanon	24
Morocco	24
Ghana	18

Benchmarking education system

Indiana-USA	81
Massachusetts-USA	81
Minnesota-USA	80
Colorado-USA	79
North Carolina-USA	76
Florida-USA	75
Connecticut-USA	72
Quebec-CAN	70
California-USA	69
Ontario-CAN	67
Alabama-USA	66
Alberta-CAN	66
Dubai-UAE	45
Abu Dhabi-UAE	44

Percent higher than International average
 Percent lower than International average

Number of kidneys son has at birth (continued)

S032614:

Student Responses

Correct Response:

How many kidneys did his son have at birth? 2

Explain your answer.

everyone has 2 kidneys

Incorrect Response:

How many kidneys did his son have at birth? two

Explain your answer.

he has two because the mother makes up the
child also.

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Human Health	Knowing

Exercise is important for health

State one reason why exercise is important for good health.

Item Number: S032640

SCORING

Correct Response

- States weight loss, preventing fat storage, lowering cholesterol, or similar.

Example: It burns fat.

- States that exercise is beneficial for the heart, circulation, oxygen levels, or similar.

Example: It keeps your heart in good condition so you don't have heart attacks.

- States building muscle strength/tone or similar.

Example: It helps build muscle.

- Other correct

Incorrect Response

- Gives only a general response related to staying healthy, fit, being strong, or similar.

- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
England-GBR	74
Hungary	73
Slovenia	70
Hong Kong-CHN	69
Finland	68
Sweden	66
United States	66
Australia	65
Kazakhstan	65
Jordan	65
Japan	65
Singapore	64
Chinese Taipei-CHN	62
New Zealand	60
Norway	60
Italy	59
Israel	59
Bahrain	58
Chile	58
Saudi Arabia	58
Turkey	55
Korea, Rep. of	54
United Arab Emirates	53
Iran, Islamic Rep. of	53
International average	53
Russian Federation	52
Syrian Arab Republic	52
Palestinian Nat'l Auth.	50
Qatar	49
Romania	49
Armenia	47
Tunisia	47
Lithuania	46
Thailand	46
Georgia	43
Oman	41
Indonesia	40
Ukraine	38
Malaysia	36
Morocco	32
Macedonia, Rep. of	28
Lebanon	23
Ghana	12

Benchmarking education system

Massachusetts-USA	77
Connecticut-USA	75
Colorado-USA	74
Ontario-CAN	72
Minnesota-USA	71
Alberta-CAN	71
North Carolina-USA	68
Florida-USA	66
Indiana-USA	66
Quebec-CAN	63
California-USA	62
Alabama-USA	59
Dubai-UAE	56
Abu Dhabi-UAE	55

Percent higher than International average
 Percent lower than International average

Exercise is important for health (continued)

S032640:

Student Responses

Correct Response:

Exercise helps you maintain weight.

Incorrect Response:

because it keeps your body in good physical shape.

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Ecosystems	Knowing

True statement about producers

Which of the following statements is true about organisms that are producers?

- A. They use energy from the sun to make food.
- B. They absorb energy from a host animal.
- C. They get energy from eating living plants.
- D. They get energy by breaking down dead plants and animals.

Item Number: S032645

Correct Response:	A
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Overall Percent Correct

Education system	Percent correct
Singapore	82
Chinese Taipei-CHN	76
Slovenia	73
Macedonia, Rep. of	68
Jordan	66
United States	66
Turkey	63
Israel	62
United Arab Emirates	59
Finland	59
England-GBR	59
Korea, Rep. of	59
Indonesia	57
Malaysia	57
Oman	57
Hong Kong-CHN	56
Georgia	56
Lithuania	55
Qatar	53
New Zealand	53
Australia	52
Thailand	50
Syrian Arab Republic	50
International average	49
Chile	48
Norway	48
Russian Federation	44
Ukraine	44
Ghana	43
Bahrain	43
Kazakhstan	41
Italy	40
Hungary	40
Palestinian Nat'l Auth.	38
Sweden	37
Saudi Arabia	36
Armenia	34
Japan	33
Iran, Islamic Rep. of	30
Lebanon	29
Romania	28
Morocco	21
Tunisia	13

Benchmarking education system

Massachusetts-USA	75
Alberta-CAN	73
North Carolina-USA	72
Florida-USA	66
Connecticut-USA	66
Minnesota-USA	66
Indiana-USA	65
Dubai-UAE	61
Abu Dhabi-UAE	60
Colorado-USA	59
Alabama-USA	59
Ontario-CAN	55
California-USA	52
Quebec-CAN	40

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Ecosystems	Reasoning

Population in countries: predict

There are more than 6 billion people in the world who share the world's natural resources. Look at the table below. It shows some information for two fictitious countries (1 and 2).

	Country 1	Country 2
Population (millions)	200	500
Annual birth rate (births per 1000 people)	10	40
Annual death rate (deaths per 1000 people)	10	10
Area in square kilometers	2,000,000	2,000,000
Grain production (percentage of world total)	40%	20%
Oil consumption (percentage of world total)	20%	5%

- A. Based on the information given in the table, predict how the population of each country will change over the next ten years.

(Check one box in each row.)

	Population Will Increase	Population Will Decrease	Population Will Stay the Same
Country 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Country 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Item Number: S032665A

SCORING

Correct Response

- Country 1: Population will stay the same.
- Country 2: Population will increase.

Incorrect Response

- Country 1 correct; Country 2 incorrect
- Country 2 correct; Country 1 incorrect
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	67
Finland	67
Chinese Taipei-CHN	57
Japan	57
Singapore	54
Sweden	53
Slovenia	53
Israel	52
Korea, Rep. of	51
England-GBR	50
Italy	49
Lithuania	49
Russian Federation	48
Australia	48
New Zealand	46
Norway	43
Hungary	41
United States	39
Turkey	35
International average	35
Ukraine	33
Iran, Islamic Rep. of	31
United Arab Emirates	30
Kazakhstan	30
Thailand	29
Bahrain	28
Chile	28
Romania	27
Tunisia	26
Armenia	24
Qatar	24
Saudi Arabia	23
Lebanon	23
Jordan	23
Macedonia, Rep. of	21
Palestinian Nat'l Auth.	17
Malaysia	16
Syrian Arab Republic	16
Morocco	15
Oman	14
Georgia	13
Indonesia	11
Ghana	6

Benchmarking education system

Massachusetts-USA	53
Ontario-CAN	53
North Carolina-USA	52
Minnesota-USA	50
Alberta-CAN	49
Quebec-CAN	48
Colorado-USA	48
Connecticut-USA	45
Indiana-USA	43
Florida-USA	39
Dubai-UAE	37
California-USA	33
Alabama-USA	31
Abu Dhabi-UAE	30

Percent higher than International average
 Percent lower than International average

Population in countries: predict (continued)

S032665A:

Student Responses**Correct Response:**

- A. Based on the information given in the table, predict how the population of each country will change over the next ten years.
(Check one box in each row.)

	Population Will Increase	Population Will Decrease	Population Will Stay the Same
Country 1	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Country 2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Incorrect Response:

- A. Based on the information given in the table, predict how the population of each country will change over the next ten years.
(Check one box in each row.)

	Population Will Increase	Population Will Decrease	Population Will Stay the Same
Country 1	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Country 2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Ecosystems	Reasoning

Population in countries: land use

There are more than 6 billion people in the world who share the world's natural resources. Look at the table below. It shows some information for two fictitious countries (1 and 2).

	Country 1	Country 2
Population (millions)	200	500
Annual birth rate (births per 1000 people)	10	40
Annual death rate (deaths per 1000 people)	10	10
Area in square kilometers	2,000,000	2,000,000
Grain production (percentage of world total)	40%	20%
Oil consumption (percentage of world total)	20%	5%

- B. Predict how the population of the two countries will affect each of the following environmental factors over the next ten years.

Land Use:

Item Number: S032665B

SCORING

Correct Response

- Predicts that land use in Country 2 is likely to increase (due to the increased population).
- Predicts that land use will increase with population. [Does not explicitly refer to Country 1 or Country 2.]
- Makes a prediction about land use based on the current population that is supported by data in the table.
- Other correct

Incorrect Response

- Makes a statement about land use that is NOT explicitly connected to either population prediction or data in the table.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	53
Japan	41
Chinese Taipei-CHN	39
Israel	36
England-GBR	35
Hong Kong-CHN	35
New Zealand	35
Australia	33
Hungary	31
Slovenia	31
United States	29
Korea, Rep. of	28
Turkey	28
Kazakhstan	26
Lithuania	25
Russian Federation	24
International average	21
Finland	21
United Arab Emirates	20
Sweden	20
Thailand	20
Ukraine	20
Bahrain	19
Iran, Islamic Rep. of	19
Jordan	18
Italy	16
Qatar	15
Palestinian Nat'l Auth.	15
Norway	14
Oman	12
Syrian Arab Republic	12
Macedonia, Rep. of	12
Malaysia	11
Chile	11
Romania	10
Tunisia	9
Armenia	8
Indonesia	8
Georgia	7
Lebanon	6
Saudi Arabia	5
Morocco	5
Ghana	3

Benchmarking education system

Ontario-CAN	47
Massachusetts-USA	43
Alberta-CAN	43
Minnesota-USA	41
Colorado-USA	36
North Carolina-USA	32
Connecticut-USA	32
Indiana-USA	31
Florida-USA	30
Dubai-UAE	28
Alabama-USA	28
Quebec-CAN	27
California-USA	22
Abu Dhabi-UAE	17

Percent higher than International average
 Percent lower than International average

Population in countries: land use (continued)

S032665B:

Student Responses

Correct Response:

country 1 will not affect so much
But country 2 will need land for more
people

Incorrect Response:

With begin to decrease slowly

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Ecosystems	Reasoning

Population in countries: pollution

There are more than 6 billion people in the world who share the world's natural resources. Look at the table below. It shows some information for two fictitious countries (1 and 2).

	Country 1	Country 2
Population (millions)	200	500
Annual birth rate (births per 1000 people)	10	40
Annual death rate (deaths per 1000 people)	10	10
Area in square kilometers	2,000,000	2,000,000
Grain production (percentage of world total)	40%	20%
Oil consumption (percentage of world total)	20%	5%

- B. Predict how the population of the two countries will affect each of the following environmental factors over the next ten years.

Pollution:

Item Number: S032665C

SCORING

Correct Response

- Predicts that pollution in Country 2 may increase (due to factors related to the growing population).

Example: There will be more pollution in Country 2 as the population increases

- Predicts that pollution will increase with population. [Does not explicitly refer to Country 1 or Country 2.]

Example: Many more people means more pollution.

- Makes a prediction about pollution based on the current population that is supported by data in the table.

Example: Country 1 will pollute more because it consumes more oil than Country 2.

- Other correct

Incorrect Response

- Makes a statement about pollution that is NOT explicitly connected to either population prediction or data in the table.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	51
Chinese Taipei-CHN	40
England-GBR	37
Australia	37
New Zealand	35
Japan	35
Turkey	34
Hungary	34
Korea, Rep. of	34
Hong Kong-CHN	32
Lithuania	32
Israel	31
United States	30
Slovenia	30
Russian Federation	28
Finland	26
Jordan	26
Iran, Islamic Rep. of	26
Kazakhstan	23
International average	22
United Arab Emirates	22
Palestinian Nat'l Auth.	20
Ukraine	20
Chile	20
Sweden	20
Thailand	19
Italy	18
Bahrain	18
Qatar	18
Tunisia	17
Syrian Arab Republic	14
Norway	14
Oman	14
Romania	13
Armenia	10
Indonesia	9
Malaysia	9
Macedonia, Rep. of	9
Georgia	9
Lebanon	8
Morocco	6
Ghana	2
Saudi Arabia	2

Benchmarking education system

Ontario-CAN	46
Minnesota-USA	43
Massachusetts-USA	41
North Carolina-USA	39
Alberta-CAN	38
Colorado-USA	38
Connecticut-USA	37
Indiana-USA	36
Quebec-CAN	30
Florida-USA	29
Dubai-UAE	28
California-USA	24
Alabama-USA	21
Abu Dhabi-UAE	21

Percent higher than International average
 Percent lower than International average

Population in countries: pollution (continued)

S032665C:

Student Responses

Correct Response:

The more people there are the
more pollution will be created

Incorrect Response:

country one will give off
more pollution than 2 will

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Characteristics, Classification, and Life Processes of Organisms	Applying

Lungs in bird/which organ in frog

Which organ in a frog has a function similar to the function of lungs in a bird?

- A. kidney
- B. skin
- C. liver
- D. heart

Item Number: S042007

Correct Response:	B
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Overall Percent Correct

Education system	Percent correct
Russian Federation	83
Ukraine	72
Tunisia	67
Lithuania	66
Singapore	62
Finland	62
Chinese Taipei-CHN	60
Korea, Rep. of	60
Slovenia	59
Hungary	59
Syrian Arab Republic	52
Italy	51
Thailand	48
Kazakhstan	47
Macedonia, Rep. of	46
Indonesia	44
Lebanon	43
International average	43
United Arab Emirates	42
Japan	42
Georgia	40
Bahrain	40
Australia	39
Iran, Islamic Rep. of	38
Saudi Arabia	38
Romania	37
Hong Kong-CHN	37
Morocco	36
Sweden	35
England-GBR	34
Israel	33
Jordan	33
New Zealand	32
Palestinian Nat'l Auth.	32
United States	32
Armenia	31
Qatar	30
Malaysia	30
Oman	28
Turkey	28
Norway	24
Chile	21
Ghana	21

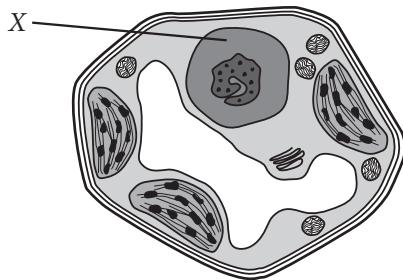
Benchmarking education system

Alberta-CAN	47
Massachusetts-USA	44
Dubai-UAE	40
Minnesota-USA	38
Colorado-USA	37
Indiana-USA	36
Abu Dhabi-UAE	36
North Carolina-USA	36
Ontario-CAN	32
Connecticut-USA	32
Florida-USA	30
Quebec-CAN	30
Alabama-USA	26
California-USA	23

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Cells and Their Functions	Applying

Function of cell part X



The diagram shows a plant cell.

What is the function of the part of the cell labeled X?

- A. It stores water.
- B. It makes food.
- C. It absorbs energy.
- D. It controls activities.

Item Number: S042017

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Singapore	80
Lithuania	51
Korea, Rep. of	49
Russian Federation	47
Tunisia	47
Oman	46
Georgia	44
United States	44
United Arab Emirates	44
Macedonia, Rep. of	43
Italy	43
Slovenia	42
Thailand	42
Ukraine	41
Malaysia	41
Hungary	41
<i>England-GBR</i>	39
Qatar	38
Australia	37
International average	36
Iran, Islamic Rep. of	35
Israel	34
Turkey	34
New Zealand	34
Armenia	33
Bahrain	33
Indonesia	33
<i>Chinese Taipei-CHN</i>	33
Jordan	32
Kazakhstan	31
Finland	30
<i>Hong Kong-CHN</i>	30
Romania	29
<i>Palestinian Nat'l Auth.</i>	28
Ghana	28
Japan	28
Saudi Arabia	27
Syrian Arab Republic	26
Lebanon	23
Morocco	22
Sweden	21
Norway	19
Chile	18

Benchmarking education system

North Carolina-USA	60
Connecticut-USA	55
Massachusetts-USA	55
Alberta-CAN	53
Indiana-USA	50
Florida-USA	49
Ontario-CAN	48
Minnesota-USA	47
Dubai-UAE	46
Abu Dhabi-UAE	44
Colorado-USA	41
Quebec-CAN	39
Alabama-USA	35
California-USA	33

Percent higher than International average
 Percent lower than International average

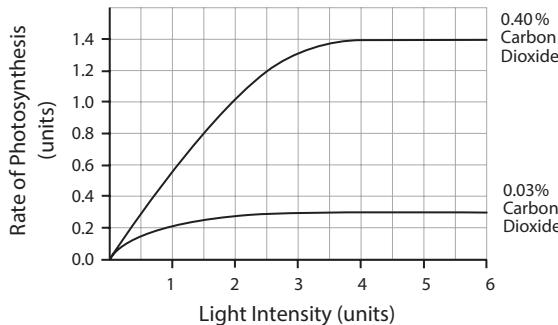
Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Cells and Their Functions	Reasoning

CO₂ concentration & photosynthesis

Andrea is investigating the effects of light intensity and carbon dioxide concentration on the rate of photosynthesis.

She measured the rate of photosynthesis at different light intensities for two identical plants. The plants were placed in closed containers. One container had an initial carbon dioxide concentration of 0.40%. The other container had an initial carbon dioxide concentration of 0.03%.

She plotted her results as shown below.



Look at the graph.

A. Does an increase in carbon dioxide concentration affect the rate of photosynthesis?

(Check one box.)

- Yes
- No

B. Explain your answer.

Item Number: S042022

SCORING

Correct Response

- Yes with an explanation that refers to carbon dioxide being required for (needed for, used during) photosynthesis. The explanation may or may not include a specific reference to the graph.

Examples:

Carbon dioxide is required for photosynthesis. The higher the concentration of carbon dioxide the faster the rate of photosynthesis.

For photosynthesis to take place it needs carbon dioxide.

- Yes with an explanation that refers only to the graph (either explicitly or implicitly).

Examples:

One with 0.03 carbon dioxide is lower than the one with 0.4 carbon dioxide.

Yes, at light intensity 3, the rate of photosynthesis is 1.2 at 0.40 and 0.3 at 0.03.

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	72
United States	68
Japan	61
England-GBR	60
Israel	52
Hong Kong-CHN	51
Korea, Rep. of	47
New Zealand	46
Australia	45
Turkey	45
Chinese Taipei-CHN	44
Tunisia	44
Finland	42
Jordan	40
Bahrain	40
Ukraine	39
United Arab Emirates	38
Slovenia	37
Kazakhstan	36
Russian Federation	36
Hungary	35
International average	35
Lithuania	34
Saudi Arabia	33
Lebanon	32
Romania	31
Malaysia	31
Norway	30
Indonesia	29
Qatar	28
Italy	27
Palestinian Nat'l Auth.	27
Oman	26
Thailand	25
Sweden	25
Iran, Islamic Rep. of	23
Chile	22
Morocco	17
Georgia	17
Macedonia, Rep. of	15
Armenia	12
Syrian Arab Republic	10
Ghana	8

Benchmarking education system

Minnesota-USA	77
Massachusetts-USA	73
Indiana-USA	71
Colorado-USA	71
Florida-USA	71
North Carolina-USA	69
Connecticut-USA	69
California-USA	65
Alabama-USA	58
Ontario-CAN	57
Alberta-CAN	57
Quebec-CAN	51
Dubai-UAE	43
Abu Dhabi-UAE	37

Percent higher than International average
 Percent lower than International average

CO₂ concentration & photosynthesis (continued)

S042022:

Student Responses

Correct Response:

- A. Does an increase in carbon dioxide concentration affect the rate of photosynthesis?

(Check one box.)

Yes

No

- B. Explain your answer.

Yes because the containers with 0.40% did ~~not~~ make the one with 0.03%.

Incorrect Response:

- A. Does an increase in carbon dioxide concentration affect the rate of photosynthesis?

(Check one box.)

Yes

No

- B. Explain your answer.

The carbon dioxide levels may rise to their initial height, but it doesn't seem to affect the units of Photosynthesis as shown in the graph.

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Cells and Their Functions	Knowing

Process of respiration

Which equation summarizes the process of respiration?

- A. water + carbon dioxide + energy → sugar + oxygen
- B. oxygen + sugar → carbon dioxide + water + energy
- C. carbon dioxide + oxygen + water → sugar + energy
- D. sugar + carbon dioxide + energy → oxygen + water

Item Number: S042024

Correct Response:	B
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Overall Percent Correct

Education system	Percent correct
Singapore	66
Russian Federation	59
Japan	52
Hong Kong-CHN	50
Kazakhstan	47
Slovenia	47
Palestinian Nat'l Auth.	47
Syrian Arab Republic	45
Saudi Arabia	45
Turkey	43
Armenia	43
England-GBR	41
Jordan	41
Israel	41
Chinese Taipei-CHN	40
Finland	40
Macedonia, Rep. of	40
Korea, Rep. of	39
Georgia	38
Bahrain	38
International average	38
Oman	38
Qatar	37
Italy	37
Romania	36
Ukraine	36
United Arab Emirates	35
Thailand	35
Chile	35
Lithuania	35
Morocco	34
Hungary	33
Tunisia	30
Sweden	30
Lebanon	29
New Zealand	28
Malaysia	27
Ghana	25
Australia	25
Iran, Islamic Rep. of	25
Norway	23
Indonesia	22
United States	22

Benchmarking education system

Dubai-UAE	38
Quebec-CAN	36
Abu Dhabi-UAE	33
Massachusetts-USA	30
North Carolina-USA	28
Alberta-CAN	27
Connecticut-USA	27
Minnesota-USA	25
Florida-USA	25
California-USA	25
Indiana-USA	23
Alabama-USA	23
Ontario-CAN	22
Colorado-USA	20

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Diversity, Adaptation, and Natural Selection	Knowing

Where organisms appeared on Earth

Where did organisms live when they first appeared on Earth?

- A. in the water
- B. in the air
- C. on the land
- D. under the ground

Item Number: S042038

Correct Response:	A
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Overall Percent Correct

Education system	Percent correct
Italy	86
Russian Federation	85
Chinese Taipei-CHN	85
Korea, Rep. of	84
Japan	83
Sweden	82
Slovenia	82
Norway	81
Finland	80
Lithuania	74
Ukraine	71
Hungary	67
Kazakhstan	63
Hong Kong-CHN	61
Georgia	61
United States	56
Armenia	56
Iran, Islamic Rep. of	52
Chile	51
England-GBR	49
Australia	47
International average	46
New Zealand	44
Macedonia, Rep. of	43
Romania	40
Israel	36
Thailand	34
Singapore	34
Malaysia	27
Turkey	26
United Arab Emirates	23
Jordan	21
Indonesia	19
Saudi Arabia	19
Qatar	18
Ghana	17
Palestinian Nat'l Auth.	17
Oman	14
Bahrain	14
Lebanon	12
Morocco	12
Syrian Arab Republic	11
Tunisia	9

Benchmarking education system	
Colorado-USA	72
Quebec-CAN	71
Massachusetts-USA	71
Minnesota-USA	66
North Carolina-USA	65
Connecticut-USA	61
Alberta-CAN	59
California-USA	59
Ontario-CAN	57
Indiana-USA	55
Florida-USA	53
Alabama-USA	48
Dubai-UAE	35
Abu Dhabi-UAE	19

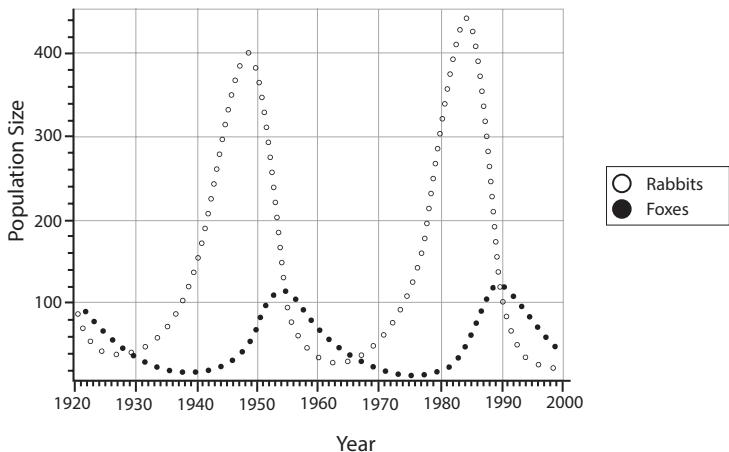
Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Ecosystems	Applying

Year of highest rabbit population

A population of rabbits and foxes live in a remote area. The foxes do not have any predators.

Scientists counted the number of rabbits and foxes over a long time period and plotted their results, as shown below.



- A. In which year was the population of rabbits at its highest?

Item Number: S042051A

SCORING

Correct Response

- 1983 - 1985

Incorrect Response

- States the year for foxes: 1988-1990
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Japan	85
Finland	78
Sweden	78
Slovenia	76
Russian Federation	74
England-GBR	73
Norway	72
Singapore	71
Hungary	71
Australia	69
United States	69
New Zealand	67
Lithuania	67
Israel	65
Italy	64
Chinese Taipei-CHN	58
Ukraine	56
Hong Kong-CHN	54
Korea, Rep. of	51
International average	47
United Arab Emirates	44
Lebanon	42
Tunisia	41
Thailand	41
Chile	40
Bahrain	40
Kazakhstan	37
Qatar	36
Romania	35
Macedonia, Rep. of	33
Georgia	31
Morocco	31
Palestinian Nat'l Auth.	31
Saudi Arabia	31
Malaysia	30
Jordan	30
Iran, Islamic Rep. of	29
Armenia	27
Oman	24
Turkey	21
Syrian Arab Republic	13
Indonesia	8
Ghana	4

Benchmarking education system

Minnesota-USA	81
Quebec-CAN	77
Massachusetts-USA	75
North Carolina-USA	74
Indiana-USA	72
Ontario-CAN	71
Colorado-USA	70
Connecticut-USA	68
Alberta-CAN	67
Florida-USA	66
California-USA	59
Alabama-USA	57
Dubai-UAE	53
Abu Dhabi-UAE	43

Percent higher than International average
 Percent lower than International average

Year of highest rabbit population (continued)

S042051A:

Student Responses

Correct Response:

- A. In which year was the population of rabbits at its highest?

1984

Incorrect Response:

- A. In which year was the population of rabbits at its highest?

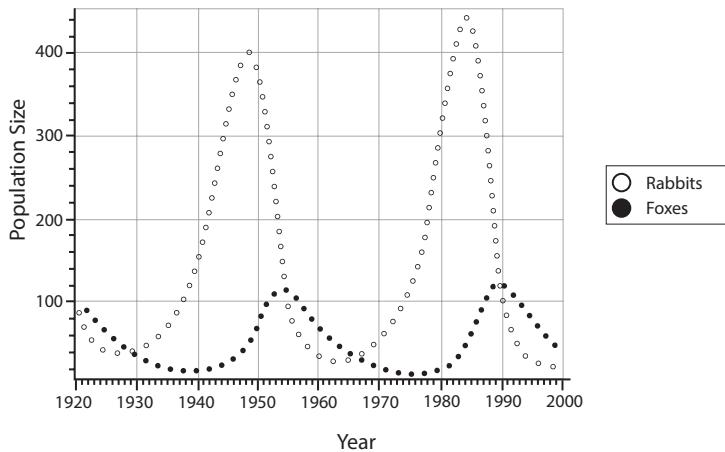
1950

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Ecosystems	Applying

Relation of rabbit-fox populations

A population of rabbits and foxes live in a remote area. The foxes do not have any predators.

Scientists counted the number of rabbits and foxes over a long time period and plotted their results, as shown below.



- B. Describe how the changes in population size of rabbits and foxes are related.

Item Number: S042051B

SCORING

Correct Response

- Describes how the changes in population are related by referring to the foxes (predators) eating the rabbits (prey).

Example: As the population of rabbits increased the foxes also increased as they have more rabbits to eat.

- Relates the graph of the fox population to that of the rabbit population without reference to predator/prey.

Example: When the rabbit population increases the fox population increases and when the rabbit population decreases the fox population decreases.

Incorrect Response

- States that foxes eat rabbits without describing how the changes in population size are related.
- Gives a general description that relates to both going up and down without mentioning how the changes in population size are related.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	68
Japan	54
England-GBR	54
Hong Kong-CHN	51
Finland	51
Korea, Rep. of	48
Israel	46
Slovenia	44
Australia	43
Chinese Taipei-CHN	42
Sweden	42
United States	36
Norway	35
Hungary	34
Lithuania	31
Italy	30
New Zealand	30
Russian Federation	28
United Arab Emirates	28
Oman	27
International average	27
Turkey	27
Jordan	26
Ukraine	25
Thailand	23
Iran, Islamic Rep. of	21
Qatar	21
Bahrain	17
Palestinian Nat'l Auth.	17
Kazakhstan	17
Malaysia	16
Syrian Arab Republic	16
Chile	13
Tunisia	11
Armenia	10
Romania	10
Lebanon	9
Indonesia	9
Macedonia, Rep. of	7
Georgia	6
Morocco	4
Ghana	2
Saudi Arabia	1

Benchmarking education system

Minnesota-USA	54
Massachusetts-USA	53
Colorado-USA	50
Alberta-CAN	48
Connecticut-USA	48
Ontario-CAN	46
Quebec-CAN	39
North Carolina-USA	39
Indiana-USA	36
Florida-USA	33
Abu Dhabi-UAE	30
Dubai-UAE	30
California-USA	22
Alabama-USA	20

Percent higher than International average
 Percent lower than International average

Relation of rabbit-fox populations (continued)

S042051B:

Student Responses

Correct Response:

They are related by when the fox population goes up the rabbit population goes down. When the fox population goes down the rabbit population goes up.

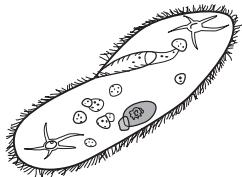
Incorrect Response:

when rabbit population goes up. Fox population goes down

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Cells and Their Functions	Knowing

Life function of Paramecium

The diagram shows a single-celled organism called a *Paramecium*.



In order to survive, the *Paramecium* carries out certain life functions, such as taking in nutrients to produce energy.

State one other life function that the *Paramecium* must carry out in order to survive.

Item Number: S042261

SCORING

Correct Response

- States one life function as noted below.

Getting rid of waste (wastes would poison the cell)

Reproduction (the species would die out otherwise)

Taking in oxygen/respire (needed to produce energy)

Responding to stimuli (moving towards food)

Digestion (breaking down food substances)

Incorrect Response

- Refers to taking in water.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	49
Israel	48
Russian Federation	46
Hungary	42
Japan	41
Slovenia	40
Ukraine	40
Finland	39
England-GBR	37
Iran, Islamic Rep. of	36
Chinese Taipei-CHN	35
Italy	33
Turkey	32
Lithuania	32
Sweden	30
Korea, Rep. of	28
United States	27
Armenia	27
Macedonia, Rep. of	27
Kazakhstan	27
Australia	26
International average	25
New Zealand	24
United Arab Emirates	24
Norway	24
Georgia	24
Bahrain	21
Jordan	18
Hong Kong-CHN	17
Syrian Arab Republic	16
Romania	16
Palestinian Nat'l Auth.	15
Thailand	15
Chile	15
Qatar	15
Oman	15
Indonesia	13
Saudi Arabia	11
Malaysia	11
Tunisia	10
Lebanon	9
Ghana	9
Morocco	8

Benchmarking education system

Massachusetts-USA	44
Alberta-CAN	36
Minnesota-USA	36
North Carolina-USA	34
Colorado-USA	34
Connecticut-USA	33
Ontario-CAN	32
Quebec-CAN	30
Indiana-USA	30
Dubai-UAE	29
Florida-USA	28
Alabama-USA	24
Abu Dhabi-UAE	22
California-USA	18

Percent higher than International average

Percent lower than International average

Life function of Paramecium (continued)

S042261:

Student Responses

Correct Response:

It Needs to take in oxygen.

Incorrect Response:

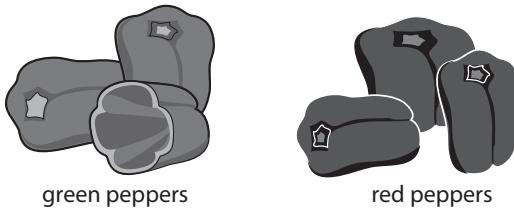
Breathing.

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Life Cycles, Reproduction, and Heredity	Reasoning

Investigation of green/red peppers

Kayra and Emre are studying plants. They have learned that characteristics such as the height of plants and the color of fruit are inherited.

They are looking at some green and red peppers.



Kayra thinks they are different kinds of peppers, because they are different colors.

Emre thinks that they are the same type of pepper, and red peppers are red because they have been left on the plant longer and have ripened.

Describe how you could set up an investigation to decide whether Kayra or Emre is correct.

Item Number: S042297

SCORING

Correct Response

- Refers to either
- i) planting (seeds from) green and red peppers AND observing the color of the fruit OR
- ii) planting (seeds from) green peppers AND observing if the fruit turns red.
- Other fully correct

Partially Correct Response

- Refers to ONLY planting (seeds from) green/red peppers.
- Example: You could grow seeds from each pepper.
- Other correct

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	44
New Zealand	37
Slovenia	30
Turkey	29
Israel	28
United States	27
Chinese Taipei-CHN	26
Hong Kong-CHN	24
Sweden	24
Chile	22
Australia	21
Finland	20
Lithuania	20
Hungary	19
Russian Federation	16
Bahrain	15
International average	14
Japan	14
Romania	14
England-GBR	14
Korea, Rep. of	12
Qatar	10
United Arab Emirates	10
Georgia	9
Thailand	9
Oman	9
Italy	9
Macedonia, Rep. of	8
Saudi Arabia	8
Syrian Arab Republic	8
Norway	8
Tunisia	8
Ukraine	8
Morocco	6
Kazakhstan	6
Armenia	6
Malaysia	5
Jordan	5
Palestinian Nat'l Auth.	4
Lebanon	4
Iran, Islamic Rep. of	2
Indonesia	2
Ghana	1

Benchmarking education system

Alberta-CAN	38
Ontario-CAN	38
Massachusetts-USA	36
Minnesota-USA	34
Colorado-USA	34
Quebec-CAN	34
Indiana-USA	32
Connecticut-USA	31
Florida-USA	25
North Carolina-USA	24
California-USA	23
Alabama-USA	18
Dubai-UAE	14
Abu Dhabi-UAE	9

Percent higher than International average
 Percent lower than International average

Investigation of green/red peppers (continued)

S042297:

Student Responses

Correct Response:

Plant 2 pepper plants with same
food, water, time spent on ground and
See if emre or Kayra is right

Partially Correct Response:

Plant a green one

Incorrect Response:

you could taste
each one to see
if they are the
same or different.

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Ecosystems	Applying

Importance of removing weeds

A farmer planted a field of corn. Weeds started to grow among the seedlings.

Explain why it is important that he remove the weeds.

Item Number: S042298

SCORING

Correct Response

- Mentions competition for resources (nutrients, water, sunlight).

Examples:

They compete with other plants for space, water and sunlight.

The weeds will compete with the seedlings for food and water.

Incorrect Response

- Mentions competition for space and/or weeds reproducing (growing) rapidly.

Examples:

They would grow very quickly and take over the field.

They reproduce too rapidly.

- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Japan	75
Chinese Taipei-CHN	74
Korea, Rep. of	65
Singapore	59
Hungary	53
Finland	49
Hong Kong-CHN	47
Kazakhstan	44
Iran, Islamic Rep. of	40
Lithuania	37
Slovenia	36
Russian Federation	35
Israel	35
Thailand	35
United States	35
England-GBR	31
Sweden	31
International average	29
Australia	29
New Zealand	28
Romania	27
Tunisia	27
Ukraine	25
Syrian Arab Republic	25
Italy	25
Norway	24
Jordan	23
Malaysia	21
Armenia	20
Turkey	20
Palestinian Nat'l Auth.	20
United Arab Emirates	17
Macedonia, Rep. of	14
Chile	14
Georgia	14
Qatar	14
Oman	12
Ghana	12
Bahrain	10
Indonesia	10
Lebanon	7
Morocco	5
Saudi Arabia	1

Benchmarking education system

Massachusetts-USA	46
Minnesota-USA	45
Alberta-CAN	45
Colorado-USA	38
North Carolina-USA	37
Indiana-USA	33
Connecticut-USA	31
Ontario-CAN	29
Florida-USA	29
California-USA	27
Alabama-USA	27
Dubai-UAE	26
Quebec-CAN	17
Abu Dhabi-UAE	15

Percent higher than International average

Percent lower than International average

Importance of removing weeds (continued)

S042298:

Student Responses

Correct Response:

It is important to remove the weeds because the weeds could absorb the nutrients and water that the corn needs to grow.

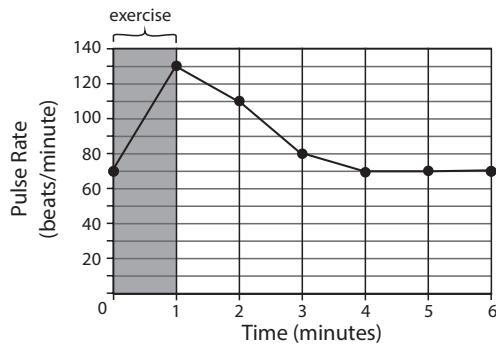
Incorrect Response:

Because the field is to dirty and he never watch the field.

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Characteristics, Classification, and Life Processes of Organisms	Reasoning

Conclusion from pulse rate-T graph

John measures his pulse rate before he exercises. It is 70 beats per minute. He exercises for one minute and measures his pulse rate again. He then measures it every minute for several minutes. He draws a graph to show his results.



What can be concluded from his results?

- A. His pulse rate increased by 50 beats per minute.
- B. His pulse rate took less time to slow down than to increase.
- C. His pulse rate after 4 minutes was 80 beats per minute.
- D. His pulse rate returned to normal in less than 6 minutes.

Item Number: S042304

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Japan	82
Korea, Rep. of	80
Finland	80
Italy	79
Russian Federation	75
Singapore	75
Sweden	75
Israel	74
Lithuania	74
Norway	73
United States	73
Slovenia	71
England-GBR	69
Australia	66
Chinese Taipei-CHN	64
New Zealand	62
Chile	62
Romania	61
Hong Kong-CHN	60
Malaysia	60
Turkey	60
International average	57
Ukraine	56
United Arab Emirates	54
Iran, Islamic Rep. of	51
Georgia	49
Tunisia	49
Hungary	48
Saudi Arabia	46
Bahrain	46
Lebanon	46
Indonesia	46
Thailand	45
Macedonia, Rep. of	45
Kazakhstan	44
Qatar	43
Jordan	43
Armenia	42
Morocco	42
Oman	42
Palestinian Nat'l Auth.	38
Syrian Arab Republic	32
Ghana	30

Benchmarking education system

Minnesota-USA	79
Massachusetts-USA	77
North Carolina-USA	76
Indiana-USA	76
Quebec-CAN	76
Connecticut-USA	75
Alberta-CAN	73
Ontario-CAN	71
Colorado-USA	70
Florida-USA	67
California-USA	64
Alabama-USA	60
Dubai-UAE	57
Abu Dhabi-UAE	55

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Ecosystems	Reasoning

Water travels through a plant

Susie has a potted plant. She sets up an experiment that shows that water travels through a plant into the air.



Which experiment would show this?

- A. Put water in a container under the pot; water will disappear from the container.
- B. Cover one of the stems of the plant with a plastic bag and water the plant; drops of water will be seen in the bag.
- C. Place a cut stem from the plant in a plastic bag; water will be seen in the bag.
- D. Place a cut stem from the plant in a glass of colored water; the plant's leaves will change color.

Item Number: S052030

Correct Response:	B
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Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	76
Tunisia	74
Japan	62
Slovenia	61
Turkey	58
Finland	57
Russian Federation	56
Israel	56
Singapore	55
Hungary	53
Chinese Taipei-CHN	52
United States	51
Sweden	50
Italy	49
Australia	49
United Arab Emirates	48
Thailand	48
Jordan	48
Morocco	47
Saudi Arabia	47
International average	47
New Zealand	46
Hong Kong-CHN	46
Lithuania	44
Georgia	44
England-GBR	44
Palestinian Nat'l Auth.	42
Ukraine	42
Romania	42
Syrian Arab Republic	42
Oman	41
Kazakhstan	40
Macedonia, Rep. of	40
Bahrain	38
Qatar	37
Norway	36
Lebanon	35
Iran, Islamic Rep. of	35
Armenia	35
Indonesia	34
Chile	33
Ghana	31
Malaysia	29

Benchmarking education system

Massachusetts-USA	57
Minnesota-USA	57
North Carolina-USA	57
Colorado-USA	56
Alberta-CAN	56
Florida-USA	56
Connecticut-USA	55
Abu Dhabi-UAE	52
Dubai-UAE	49
Ontario-CAN	46
Indiana-USA	45
California-USA	45
Alabama-USA	43
Quebec-CAN	38

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Human Health	Knowing

Foods diabetics should avoid

John has diabetes.
Which of the following should he be careful about eating or drinking?

A. beef
B. eggs
C. milk
D. fruit juice

Item Number: S052080

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	81 ▲
Sweden	81 ▲
Russian Federation	80 ▲
Slovenia	78 ▲
Israel	78 ▲
Korea, Rep. of	76 ▲
Turkey	76 ▲
Hong Kong-CHN	76 ▲
Japan	75 ▲
Hungary	73 ▲
Finland	70 ▲
Lithuania	67 ▲
Ukraine	67 ▲
Iran, Islamic Rep. of	65 ▲
Norway	64
New Zealand	64
Saudi Arabia	64
Bahrain	63
Australia	63
Jordan	62
Tunisia	62
United States	62
England-GBR	62
International average	61
Kazakhstan	60
Singapore	59
Armenia	59
Syrian Arab Republic	58
Oman	57 ▼
United Arab Emirates	57 ▼
Italy	57
Palestinian Nat'l Auth.	57 ▼
Georgia	56
Morocco	53 ▼
Qatar	50 ▼
Romania	48 ▼
Thailand	47 ▼
Chile	44 ▼
Macedonia, Rep. of	41 ▼
Ghana	41 ▼
Lebanon	38 ▼
Indonesia	36 ▼
Malaysia	26 ▼

Benchmarking education system

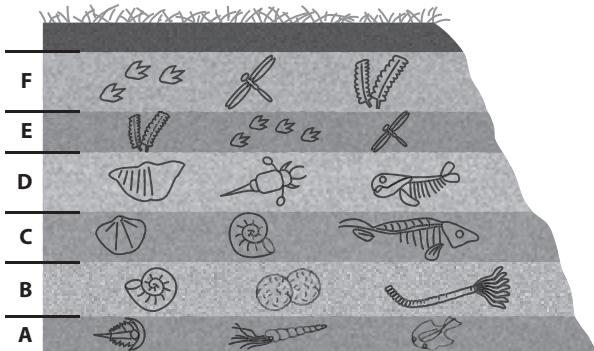
Alberta-CAN	75 ▲
Quebec-CAN	74 ▲
Ontario-CAN	71 ▲
North Carolina-USA	71 ▲
Minnesota-USA	71 ▲
Massachusetts-USA	70 ▲
Connecticut-USA	69 ▲
Colorado-USA	65
Indiana-USA	61
Abu Dhabi-UAE	61
Alabama-USA	60
California-USA	58
Florida-USA	58
Dubai-UAE	56 ▼

▲ Percent higher than International average
▼ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Diversity, Adaptation, and Natural Selection	Applying

Layers of rock with fossils

The diagram below shows geological layers of rock containing fossils. Layer F is the uppermost layer, while Layer A is the deepest layer.



Which statement about the age of the fossils is most likely correct?

- A. Fossils in Layer A are the oldest, because they are located in the deepest layer.
- B. Fossils in Layer C are the youngest, because they look similar to existing organisms.
- C. Fossils in Layer D are older than fossils in Layer A, because the fossils in Layer D are bigger.
- D. Fossils in Layer E are the same age as those in Layer F because they look the same.

Item Number: S052088

Correct Response:	A
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Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	89 ▲
Japan	85 ▲
Korea, Rep. of	85 ▲
United States	84 ▲
England-GBR	84 ▲
Hong Kong-CHN	84 ▲
Singapore	83 ▲
Israel	79 ▲
Australia	79 ▲
Slovenia	78 ▲
New Zealand	76 ▲
Finland	75 ▲
Jordan	74 ▲
Italy	73 ▲
Lithuania	73 ▲
Iran, Islamic Rep. of	70 ▲
Sweden	69 ▲
Russian Federation	69 ▲
Hungary	69 ▲
United Arab Emirates	68 ▲
Norway	67
Chile	65
Ukraine	65
International average	64
Romania	61
Turkey	59 ▼
Macedonia, Rep. of	58 ▼
Kazakhstan	57 ▼
Lebanon	55 ▼
Bahrain	54 ▼
Oman	54 ▼
Malaysia	53 ▼
Qatar	52 ▼
Georgia	51 ▼
Palestinian Nat'l Auth.	50 ▼
Syrian Arab Republic	50 ▼
Morocco	49 ▼
Saudi Arabia	49 ▼
Tunisia	47 ▼
Indonesia	43 ▼
Armenia	38 ▼
Thailand	37 ▼
Ghana	36 ▼

Benchmarking education system

Minnesota-USA	92 ▲
Massachusetts-USA	90 ▲
North Carolina-USA	90 ▲
Indiana-USA	86 ▲
Florida-USA	86 ▲
Alberta-CAN	83 ▲
Colorado-USA	83 ▲
Connecticut-USA	81 ▲
Alabama-USA	80 ▲
Quebec-CAN	80 ▲
California-USA	79 ▲
Ontario-CAN	77 ▲
Dubai-UAE	69 ▲
Abu Dhabi-UAE	65

▲ Percent higher than International average
▼ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Ecosystems	Reasoning

Mayor wants to plant trees

The amount of carbon dioxide in the air is increasing in a large city due to the growing number of vehicles. The mayor wants to plant more trees.

A. Do you agree with the mayor's suggestion?

(Check one box.)

- Yes
 No

B. Explain your answer.

Item Number: S052091

SCORING

Correct Response

- Yes with an explanation that trees absorb carbon dioxide (during photosynthesis).

Examples:

Yes – When trees photosynthesize they take in carbon dioxide and give out oxygen.

Yes – Trees take in carbon dioxide.

- No with a valid explanation related to reducing carbon dioxide emission.

Examples:

No – The mayor should suggest ways to cut the amount of carbon dioxide by getting people to walk or cycle.

No – I disagree with the mayor, as planting more trees won't solve the problem the same way as lessening the amount of cars on the road.

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task), including the following response:

Explanation relates to oxygen only.

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	76
Singapore	73
Chinese Taipei-CHN	70
Kazakhstan	69
Japan	67
Korea, Rep. of	64
Russian Federation	54
Bahrain	54
Jordan	52
Thailand	51
England-GBR	51
Tunisia	50
Romania	49
United Arab Emirates	48
Israel	48
Oman	48
Syrian Arab Republic	47
New Zealand	47
Iran, Islamic Rep. of	46
International average	46
Australia	45
Malaysia	45
Slovenia	43
Sweden	43
Indonesia	42
Qatar	42
Saudi Arabia	41
Palestinian Nat'l Auth.	40
Turkey	40
Italy	39
Hungary	39
United States	39
Finland	38
Norway	38
Georgia	36
Ukraine	36
Lebanon	35
Macedonia, Rep. of	35
Armenia	33
Lithuania	29
Morocco	27
Chile	26
Ghana	24

Benchmarking education system

Dubai-UAE	56
Massachusetts-USA	55
Alberta-CAN	54
Abu Dhabi-UAE	50
Ontario-CAN	50
Minnesota-USA	46
Colorado-USA	45
Quebec-CAN	45
Florida-USA	44
Indiana-USA	41
North Carolina-USA	39
Connecticut-USA	39
California-USA	29
Alabama-USA	25

Percent higher than International average
 Percent lower than International average

Mayor wants to plant trees (continued)

S052091:

Student Responses

Correct Response:

A. Do you agree with the mayor's suggestion?

(Check one box.)

Yes

No

B. Explain your answer.

Because the tree's would absorb the carbon dioxide.

Incorrect Response:

A. Do you agree with the mayor's suggestion?

(Check one box.)

Yes

No

B. Explain your answer.

yes, because trees make oxygen so that we can stay alive.

Content Domain	Main Topic	Cognitive Domain
BIOLOGY	Life Cycles, Reproduction, and Heredity	Applying

Genetic makeup of twins

Twins are born. One is a boy and one is a girl.

Which statement is correct about their genetic makeup?

- A. The boy and the girl inherit genetic material from the father only.
- B. The boy and girl inherit genetic material from the mother only.
- C. The boy and girl inherit genetic material from both parents.
- D. The boy inherits genetic material from the father only and the girl inherits it from the mother only.

Item Number: S052093

Correct Response:	C
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Overall Percent Correct

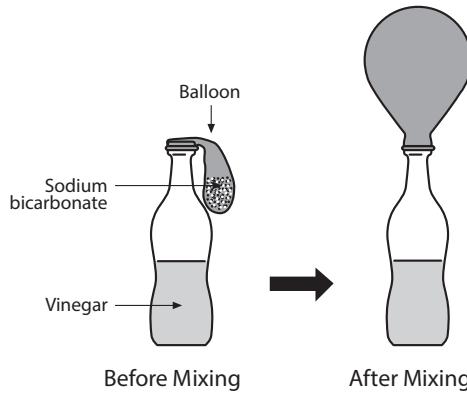
Education system	Percent correct
Japan	95
Finland	94
Korea, Rep. of	93
Singapore	92
Slovenia	91
Jordan	91
United States	90
Israel	90
Chinese Taipei-CHN	89
England-GBR	88
Hong Kong-CHN	88
Russian Federation	88
Italy	88
Hungary	87
Armenia	87
Tunisia	87
Ukraine	86
United Arab Emirates	86
Australia	86
Bahrain	85
Saudi Arabia	85
New Zealand	85
Lithuania	84
Turkey	84
Palestinian Nat'l Auth.	84
International average	83
Sweden	83
Romania	83
Norway	82
Qatar	82
Syrian Arab Republic	81
Oman	81
Morocco	80
Chile	80
Kazakhstan	79
Thailand	77
Georgia	76
Lebanon	76
Iran, Islamic Rep. of	75
Indonesia	70
Ghana	69
Malaysia	69
Macedonia, Rep. of	63

Benchmarking education system

Massachusetts-USA	95
Minnesota-USA	94
Indiana-USA	92
North Carolina-USA	91
Connecticut-USA	89
Alberta-CAN	89
Colorado-USA	89
Alabama-USA	88
Florida-USA	87
Quebec-CAN	87
Ontario-CAN	87
California-USA	86
Abu Dhabi-UAE	86
Dubai-UAE	86

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Chemical Change	Applying

Sodium bicarbonate in vinegar

As shown in the diagram, the balloon inflates when the sodium bicarbonate in the balloon is mixed with the vinegar.

What causes this to happen?

Item Number: S032056

SCORING**Correct Response**

- States that carbon dioxide is given off (as a result of chemical reaction).
- Example: Chemical reaction expels carbon dioxide which blows the balloon up.
- States that a gas is given off (as a result of chemical reaction). [Does NOT explicitly mention carbon dioxide.]
- Example: When they mix the two chemicals, a gas is produced and it goes up into the balloon.
- States that a chemical reaction occurs. [Does NOT explicitly mention gas production.]
- Example: Vinegar has a reaction when it is mixed with sodium bicarbonate.
- Other correct

Incorrect Response

- Refers only to gas (air) rising into the balloon, or similar. [No mention of chemical reaction or gas production.]
- Refers to production of air, helium or some other incorrect gas.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	64
Singapore	62
Kazakhstan	61
England-GBR	58
Russian Federation	57
Australia	55
Japan	52
New Zealand	52
United States	51
Hong Kong-CHN	51
Slovenia	51
Bahrain	50
Saudi Arabia	49
United Arab Emirates	45
Hungary	45
Korea, Rep. of	42
Italy	41
Finland	39
Jordan	39
Norway	39
International average	38
Israel	38
Ukraine	38
Lithuania	37
Sweden	37
Romania	36
Iran, Islamic Rep. of	34
Chile	34
Thailand	33
Armenia	32
Syrian Arab Republic	31
Lebanon	31
Qatar	30
Turkey	29
Macedonia, Rep. of	26
Palestinian Nat'l Auth.	26
Indonesia	25
Malaysia	23
Oman	22
Morocco	14
Tunisia	14
Georgia	13
Ghana	6

Benchmarking education system

Alberta-CAN	60
Massachusetts-USA	60
Colorado-USA	57
Florida-USA	56
California-USA	52
North Carolina-USA	51
Minnesota-USA	50
Quebec-CAN	50
Dubai-UAE	49
Indiana-USA	49
Connecticut-USA	44
Abu Dhabi-UAE	44
Ontario-CAN	41
Alabama-USA	36

Percent higher than International average
 Percent lower than International average

Sodium bicarbonate in vinegar (continued)

S032056:

Student Responses

Correct Response:

The chemical reaction releases a gas
which fills up the balloon.

Incorrect Response:

The warm air.

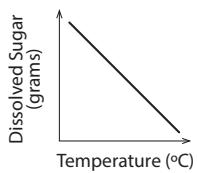
Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Properties of Matter	Reasoning

Solubility/temperature graphs

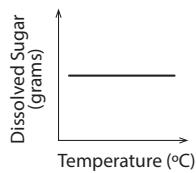
Bob did an experiment to investigate the effect of temperature on the solubility of sugar in water by measuring the amount of sugar that would dissolve in 1 liter of water at different temperatures. He then plotted his results.

Which of the following is likely to be the graph showing Bob's results?

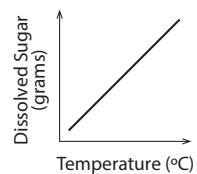
A.



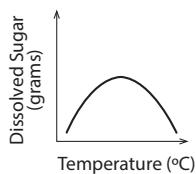
B.



C.



D.



Item Number: S032156

Correct Response:**C****Overall Percent Correct**

Education system	Percent correct
Korea, Rep. of	82
Japan	77
<i>Chinese Taipei-CHN</i>	76
Singapore	66
Finland	57
Slovenia	57
<i>England-GBR</i>	57
Russian Federation	56
Australia	55
<i>Hong Kong-CHN</i>	54
Malaysia	54
United States	54
Israel	54
New Zealand	54
Hungary	52
Turkey	52
Lithuania	51
Bahrain	48
<i>Palestinian Nat'l Auth.</i>	45
International average	45
Jordan	44
Oman	44
Ukraine	43
United Arab Emirates	42
Norway	41
Sweden	40
Qatar	40
Lebanon	40
Tunisia	39
Kazakhstan	39
Italy	36
Thailand	36
Chile	34
Saudi Arabia	34
Morocco	29
Romania	28
Georgia	26
Macedonia, Rep. of	26
Armenia	26
Iran, Islamic Rep. of	25
Syrian Arab Republic	21
Indonesia	21
Ghana	18

Benchmarking education system

Alberta-CAN	65
Massachusetts-USA	61
California-USA	59
Colorado-USA	58
Indiana-USA	58
Connecticut-USA	58
Minnesota-USA	57
North Carolina-USA	55
Florida-USA	54
Alabama-USA	48
Ontario-CAN	47
Dubai-UAE	47
Abu Dhabi-UAE	43
Quebec-CAN	42

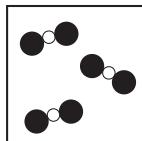
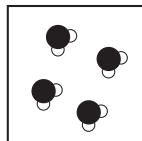
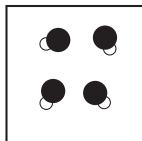
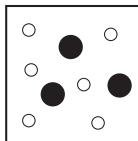
Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Applying

Diagram of water molecules

In the diagrams below, hydrogen atoms are represented by white circles, and oxygen atoms are represented by black circles.

Which of the diagrams best represents water?



A.

B.

C.

D.

Item Number: S032502

Correct Response:	C
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Overall Percent Correct

Education system	Percent correct
Finland	83
Russian Federation	79
Slovenia	77
Japan	73
Sweden	72
Chinese Taipei-CHN	71
Lithuania	65
Hungary	65
Singapore	62
Turkey	61
Ukraine	57
United States	55
Iran, Islamic Rep. of	54
Israel	50
Italy	48
Norway	47
Kazakhstan	47
International average	46
Korea, Rep. of	45
Bahrain	44
Australia	43
Malaysia	43
New Zealand	41
Armenia	40
Morocco	40
England-GBR	39
Romania	39
Syrian Arab Republic	39
Lebanon	39
Chile	38
Saudi Arabia	37
Macedonia, Rep. of	36
United Arab Emirates	35
Qatar	35
Jordan	32
Palestinian Nat'l Auth.	30
Georgia	28
Hong Kong-CHN	25
Oman	23
Thailand	19
Indonesia	18
Tunisia	17
Ghana	16

Benchmarking education system

North Carolina-USA	71
Massachusetts-USA	64
California-USA	59
Indiana-USA	56
Colorado-USA	54
Florida-USA	52
Minnesota-USA	52
Connecticut-USA	50
Alabama-USA	46
Quebec-CAN	45
Dubai-UAE	38
Abu Dhabi-UAE	37
Alberta-CAN	33
Ontario-CAN	28

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Reasoning

Identify if substance is metal

David is given a sample of an unknown solid substance. He wants to know if the substance is a metal. Write down one property he can observe or measure and describe how this property could be used to help identify whether the substance is a metal.

Overall Percent Correct

Education system	Percent correct
Japan	72
Slovenia	69
Singapore	64
England-GBR	61
Israel	58
Chinese Taipei-CHN	56
Hong Kong-CHN	52
Kazakhstan	49
United States	48
Russian Federation	48
Hungary	46
Sweden	45
Jordan	45
Finland	44
Lithuania	42
New Zealand	41
Ukraine	41
Iran, Islamic Rep. of	40
Australia	38
International average	35
Norway	34
Palestinian Nat'l Auth.	32
Saudi Arabia	31
Armenia	31
Korea, Rep. of	31
Bahrain	29
Turkey	29
Qatar	28
United Arab Emirates	24
Italy	24
Ghana	23
Romania	22
Macedonia, Rep. of	22
Lebanon	21
Thailand	20
Malaysia	18
Syrian Arab Republic	17
Georgia	16
Tunisia	15
Oman	15
Chile	13
Indonesia	10
Morocco	7

Item Number: S032570

SCORING

Correct Response

- Response based on a characteristic property of common metals that can be measured (e.g., conductor of heat, conductor of electricity, thermal expansion, density, magnetic properties, melting point).
- Response based on physical appearance or form (e.g., shiny appearance, hardness, malleability/ductility).
- Response based on chemical reactivity of metals (e.g., tendency to undergo oxidation, reaction with acid).
- Other correct

Incorrect Response

- Refers to a magnetic test that is incorrect; no procedure given or indicates that all metals are attracted to magnets or that NON-attraction indicates a non-metal.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Benchmarking education system

Massachusetts-USA	65
North Carolina-USA	56
Minnesota-USA	50
Indiana-USA	49
Connecticut-USA	47
Colorado-USA	47
California-USA	45
Alberta-CAN	42
Dubai-UAE	41
Florida-USA	41
Quebec-CAN	39
Ontario-CAN	35
Alabama-USA	35
Abu Dhabi-UAE	19

Percent higher than International average
 Percent lower than International average

Identify if substance is metal (continued)

S032570:

Student Responses

Correct Response:

He can weigh it ,or feel how hard it is.
A metcal is tested by it texture ,hardness,
shape and size; so if you use hardness
you should no probem.

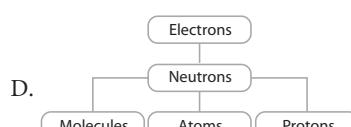
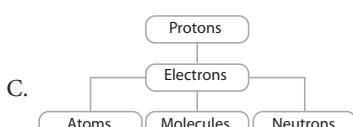
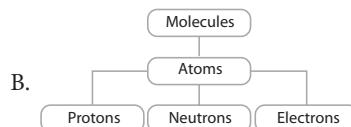
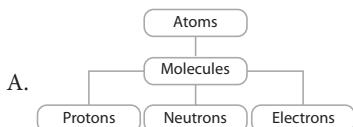
Incorrect Response:

if it is magnetic it is metal.

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Applying

Diagram for structure of matter

Which of these diagrams best represents the structure of matter, starting with the more complex particles at the top and ending with the more fundamental particles at the bottom?



Item Number: S032579

Correct Response:	B
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Overall Percent Correct

Education system	Percent correct
Slovenia	65
Singapore	62
Russian Federation	62
Israel	52
Finland	51
Lithuania	51
Italy	51
Kazakhstan	51
Ukraine	51
Hungary	49
Iran, Islamic Rep. of	48
United States	46
Lebanon	46
Armenia	46
Chile	45
Macedonia, Rep. of	44
Turkey	43
<i>Chinese Taipei-CHN</i>	41
Romania	41
International average	41
Sweden	39
Norway	39
New Zealand	39
Tunisia	39
Jordan	39
Thailand	38
United Arab Emirates	37
Oman	36
Georgia	36
<i>Palestinian Nat'l Auth.</i>	35
Australia	34
Korea, Rep. of	34
<i>England-GBR</i>	33
Bahrain	32
Malaysia	32
Syrian Arab Republic	32
Saudi Arabia	31
Morocco	31
Qatar	28
Japan	27
Indonesia	25
<i>Hong Kong-CHN</i>	24
Ghana	19

Benchmarking education system

Massachusetts-USA	51
Connecticut-USA	46
California-USA	46
North Carolina-USA	45
Quebec-CAN	44
Indiana-USA	43
Florida-USA	43
Colorado-USA	42
Dubai-UAE	39
Abu Dhabi-UAE	38
Minnesota-USA	37
Ontario-CAN	33
Alabama-USA	32
Alberta-CAN	30

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Chemical Change	Applying

Energy released during a reaction

Write down one thing you might observe that shows that energy has been released during a chemical reaction.

Overall Percent Correct

Education system	Percent correct
Finland	49
Slovenia	48
<i>Chinese Taipei-CHN</i>	43
Singapore	30
Kazakhstan	28
New Zealand	27
Ukraine	27
Japan	26
Iran, Islamic Rep. of	24
Australia	24
<i>Hong Kong-CHN</i>	23
United States	22
Lithuania	22
United Arab Emirates	22
Russian Federation	22
Israel	20
<i>England-GBR</i>	19
Syrian Arab Republic	18
International average	18
Sweden	17
Bahrain	16
Hungary	15
Qatar	15
Norway	14
Saudi Arabia	14
Jordan	12
Armenia	12
Lebanon	12
Korea, Rep. of	12
Chile	11
Romania	11
Macedonia, Rep. of	10
Oman	10
<i>Palestinian Nat'l Auth.</i>	10
Turkey	9
Malaysia	8
Italy	8
Morocco	7
Ghana	6
Tunisia	6
Thailand	6
Georgia	4
Indonesia	4

Item Number: S032679

SCORING

Correct Response

- Refers to heat or temperature increase (or similar).
- Refers to explosion or hearing sound (or similar).
- Refers to light production or seeing flames (or similar).
- Other correct

Example: If the chemical reaction causes something to move, like with a rocket blast.

Incorrect Response

- Refers only to steam, smoke, bubbling, gas production (or similar). [No explicit reference to heat.]
- Refers only to other evidence of change in materials that does not necessarily indicate that energy has been released (e.g., smell, color change).
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Benchmarking education system

Alberta-CAN	32
Minnesota-USA	25
North Carolina-USA	25
Ontario-CAN	25
Indiana-USA	24
Quebec-CAN	24
Abu Dhabi-UAE	23
Massachusetts-USA	23
Connecticut-USA	22
Florida-USA	21
Dubai-UAE	21
California-USA	20
Colorado-USA	17
Alabama-USA	14

Percent higher than International average
 Percent lower than International average

Energy released during a reaction (continued)

S032679:

Student Responses

Correct Response:

When a chemical reaction releases energy, the substance will be warm or hot.

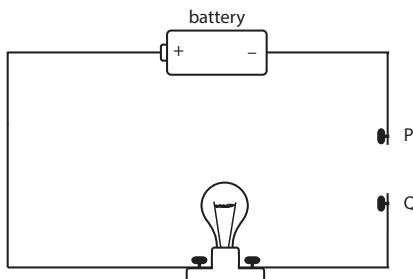
Incorrect Response:

The chemicals start foaming.

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Applying

Which rod causes the bulb to light

Rods made of different materials are connected between points P and Q in the circuit diagram shown below.



Which rod would cause the bulb to light?

- A. copper rod
- B. wood rod
- C. glass rod
- D. plastic rod

Item Number: S042063

Correct Response:	A
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Overall Percent Correct

Education system	Percent correct
Russian Federation	97
Hong Kong-CHN	96
Lithuania	96
Singapore	96
Israel	95
Slovenia	95
England-GBR	95
Finland	94
Chinese Taipei-CHN	94
Japan	94
Chile	94
Thailand	93
Sweden	93
Indonesia	92
New Zealand	92
Turkey	92
Iran, Islamic Rep. of	91
Italy	91
Morocco	91
United States	90
Australia	89
Tunisia	88
Korea, Rep. of	88
Jordan	88
International average	88
Palestinian Nat'l Auth.	87
Norway	87
Romania	87
Syrian Arab Republic	87
Hungary	87
Ukraine	86
United Arab Emirates	84
Malaysia	84
Bahrain	83
Macedonia, Rep. of	83
Qatar	80
Saudi Arabia	80
Kazakhstan	80
Georgia	80
Armenia	79
Lebanon	78
Oman	73
Ghana	69

Benchmarking education system

Alberta-CAN	95
Indiana-USA	95
Minnesota-USA	93
Massachusetts-USA	93
North Carolina-USA	93
Connecticut-USA	92
Florida-USA	90
Ontario-CAN	90
Quebec-CAN	90
Colorado-USA	90
Dubai-UAE	90
Alabama-USA	87
California-USA	85
Abu Dhabi-UAE	83

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Knowing

Formula for carbon dioxide

What is the chemical formula for carbon dioxide?

- A. CO
- B. CO₂
- C. C
- D. O₂

Item Number: S042073

Correct Response:	B
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Overall Percent Correct

Education system	Percent correct
Japan	99
Chinese Taipei-CHN	98
Lebanon	97
Slovenia	96
Romania	94
Hungary	93
England-GBR	92
Russian Federation	92
Armenia	91
Singapore	91
Korea, Rep. of	90
Italy	90
Hong Kong-CHN	89
Indonesia	89
Ukraine	88
Kazakhstan	88
Macedonia, Rep. of	88
Qatar	87
Syrian Arab Republic	87
Israel	86
Oman	86
Jordan	86
United States	86
Lithuania	85
International average	85
Palestinian Nat'l Auth.	85
Australia	84
Norway	84
New Zealand	84
Turkey	83
United Arab Emirates	83
Morocco	82
Sweden	81
Finland	81
Chile	80
Ghana	79
Bahrain	79
Saudi Arabia	75
Tunisia	73
Thailand	73
Georgia	68
Malaysia	67
Iran, Islamic Rep. of	59

Benchmarking education system

Alberta-CAN	93
Minnesota-USA	93
Colorado-USA	90
Dubai-UAE	90
Florida-USA	89
Massachusetts-USA	89
North Carolina-USA	88
Connecticut-USA	87
Ontario-CAN	85
Abu Dhabi-UAE	84
Indiana-USA	84
Quebec-CAN	84
Alabama-USA	81
California-USA	79

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Knowing

Number of atoms in H₂SO₄ molecule

Complete the table below to show the number of atoms of each element in a molecule of sulfuric acid (H₂SO₄).

Element	Number of Atoms
Hydrogen	
Sulfur	
Oxygen	

Item Number: S042076

SCORING**Correct Response**

- Completes the table as shown below:

Element	Number of Atoms
Hydrogen	2
Sulfur	1
Oxygen	4

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	69
Russian Federation	64
Slovenia	58
Japan	53
Ukraine	50
Lebanon	49
United States	48
Kazakhstan	47
Macedonia, Rep. of	47
Lithuania	47
Armenia	46
Chinese Taipei-CHN	44
Romania	43
England-GBR	41
Iran, Islamic Rep. of	38
Finland	37
Italy	36
Israel	34
International average	33
Oman	32
United Arab Emirates	32
Hungary	31
Turkey	31
New Zealand	31
Sweden	30
Chile	30
Australia	27
Norway	27
Korea, Rep. of	26
Qatar	25
Jordan	24
Palestinian Nat'l Auth.	23
Syrian Arab Republic	23
Thailand	21
Hong Kong-CHN	21
Bahrain	21
Morocco	19
Malaysia	18
Georgia	11
Saudi Arabia	10
Ghana	8
Indonesia	7
Tunisia	2

Benchmarking education system

Massachusetts-USA	68
California-USA	57
North Carolina-USA	53
Colorado-USA	53
Indiana-USA	49
Minnesota-USA	41
Quebec-CAN	41
Connecticut-USA	40
Dubai-UAE	38
Alabama-USA	38
Florida-USA	34
Abu Dhabi-UAE	33
Alberta-CAN	12
Ontario-CAN	12

Percent higher than International average

Percent lower than International average

Number of atoms in H₂SO₄ molecule (continued)

S042076:

Student Responses

Correct Response:

Element	Number of Atoms
Hydrogen	2
Sulfur	1
Oxygen	4

Incorrect Response:

Element	Number of Atoms
Hydrogen	2
Sulfur	0
Oxygen	4

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Properties of Matter	Knowing

Ammonia solution mixed in vinegar

Robert put two drops of an indicator into vinegar, and the color turned red. He then added drops of ammonia solution until the color disappeared.

What process occurred?

- A. rusting
- B. melting
- C. evaporation
- D. neutralization

Item Number: S042095

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	91
Finland	90
Singapore	89
Hong Kong-CHN	88
Russian Federation	87
Ukraine	81
Norway	80
England-GBR	79
Iran, Islamic Rep. of	77
Hungary	77
United States	74
Jordan	73
Japan	73
Australia	72
Sweden	70
Turkey	69
Armenia	68
Italy	68
New Zealand	68
United Arab Emirates	67
International average	67
Slovenia	65
Lithuania	65
Bahrain	65
Korea, Rep. of	63
Malaysia	63
Romania	62
Chile	62
Qatar	61
Kazakhstan	61
Israel	60
Oman	59
Syrian Arab Republic	58
Indonesia	58
Tunisia	58
Thailand	57
Saudi Arabia	54
Georgia	54
Morocco	51
Lebanon	48
Palestinian Nat'l Auth.	48
Macedonia, Rep. of	47
Ghana	34

Benchmarking education system

North Carolina-USA	81
Minnesota-USA	79
Massachusetts-USA	78
Indiana-USA	78
Alberta-CAN	75
Florida-USA	74
Connecticut-USA	72
California-USA	72
Colorado-USA	71
Dubai-UAE	71
Abu Dhabi-UAE	70
Ontario-CAN	69
Alabama-USA	63
Quebec-CAN	54

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Chemical Change	Knowing

Observations for reaction

Ahmet put some powder into a test tube. He then added liquid to the powder and shook the test tube. A chemical reaction took place.

Describe two things he might observe as the chemical reaction took place.

1.

2.

Item Number: S042100

SCORING**Correct Response**

- Describes two different observations as listed below.

Appearance of a new color (color change)

Seeing gas production (bubbling, foaming)

Hearing a noise (fizzing)

Smelling a gas

Changing temperature (increase or decrease)

A precipitate forming

Light being emitted

An explosion taking place

Partially Correct Response

- Describes one observation as listed above.

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task).

Overall Percent Correct

Education system	Percent correct
England-GBR	59
New Zealand	50
United States	46
Chinese Taipei-CHN	44
Russian Federation	44
Singapore	44
Australia	42
United Arab Emirates	37
Finland	36
Hong Kong-CHN	35
Norway	32
Japan	30
Saudi Arabia	30
Syrian Arab Republic	30
Slovenia	30
Jordan	28
Ukraine	27
International average	24
Bahrain	23
Israel	23
Korea, Rep. of	23
Lebanon	22
Qatar	22
Lithuania	21
Palestinian Nat'l Auth.	21
Sweden	18
Tunisia	18
Kazakhstan	17
Romania	17
Oman	17
Iran, Islamic Rep. of	17
Hungary	15
Armenia	14
Malaysia	10
Italy	9
Turkey	8
Thailand	8
Chile	7
Indonesia	6
Macedonia, Rep. of	5
Morocco	4
Georgia	3
Ghana	1

Benchmarking education system

Minnesota-USA	53
Massachusetts-USA	52
Indiana-USA	51
Colorado-USA	51
North Carolina-USA	47
Quebec-CAN	44
California-USA	44
Florida-USA	42
Dubai-UAE	39
Abu Dhabi-UAE	39
Alabama-USA	38
Connecticut-USA	37
Alberta-CAN	37
Ontario-CAN	32

Percent higher than International average
 Percent lower than International average

Observations for reaction (continued)

S042100:

Student Responses

Correct Response:

Describe two things he might observe as the chemical reaction took place.

1. That the powder and the liquid could explode.
2. The reaction could make a horrible smell, or the powder might change colors.

Partially Correct Response:

Describe two things he might observe as the chemical reaction took place.

1. The powder dissolved.
2. The liquid thickened.

Incorrect Response:

Describe two things he might observe as the chemical reaction took place.

1. The color
2. What the reaction was if it was gas, metal or liquid

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Chemical Change	Knowing

Process in which energy absorbed

During which chemical process is energy absorbed?

- A. iron nails rusting
- B. candles burning
- C. vegetables rotting
- D. plants photosynthesizing

Item Number: S042112

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	83
Korea, Rep. of	79
Chile	77
England-GBR	75
Chinese Taipei-CHN	75
United States	74
Australia	71
New Zealand	70
Singapore	70
Sweden	69
Italy	67
Israel	65
Finland	62
United Arab Emirates	62
Japan	61
Palestinian Nat'l Auth.	60
Jordan	60
Syrian Arab Republic	60
Armenia	59
Thailand	59
Hungary	59
Ukraine	58
International average	58
Russian Federation	57
Turkey	56
Bahrain	56
Oman	55
Lithuania	54
Qatar	52
Norway	51
Tunisia	51
Romania	51
Saudi Arabia	49
Macedonia, Rep. of	48
Georgia	48
Kazakhstan	46
Morocco	45
Ghana	45
Slovenia	43
Malaysia	42
Indonesia	42
Iran, Islamic Rep. of	41
Lebanon	40

Benchmarking education system

Minnesota-USA	78
Indiana-USA	78
Massachusetts-USA	77
Alberta-CAN	76
Ontario-CAN	76
North Carolina-USA	74
Florida-USA	73
Connecticut-USA	70
California-USA	68
Colorado-USA	67
Alabama-USA	66
Dubai-UAE	65
Quebec-CAN	65
Abu Dhabi-UAE	61

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Applying

Classify element/compound/mixture

The table below shows some elements, compounds, and mixtures.

Classify them by putting an X in the appropriate column beside each one.

	Element	Compound	Mixture
Air			
Sugar			
Salt			
Gold			
Sea water			
Helium			

Item Number: S042305

SCORING

Correct Response

- Classifies all 6 correctly.

	Element	Compound	Mixture
Air			X
Sugar		X	
Salt		X	
Gold	X		
Sea Water			X
Helium	X		

Partially Correct Response

- Classifies 4 or 5 correctly.

Incorrect Response

- Classifies 2 or 3 correctly.
- Classifies 1 correctly.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	33
Singapore	29
Slovenia	28
Russian Federation	27
Kazakhstan	25
Israel	18
Hungary	17
Qatar	17
Finland	16
Macedonia, Rep. of	15
Palestinian Nat'l Auth.	15
England-GBR	15
Ukraine	15
Turkey	13
United Arab Emirates	12
International average	11
New Zealand	11
Lithuania	11
United States	10
Ghana	10
Japan	10
Lebanon	10
Romania	9
Bahrain	9
Korea, Rep. of	9
Australia	8
Hong Kong-CHN	8
Oman	7
Malaysia	7
Iran, Islamic Rep. of	6
Sweden	6
Norway	6
Chile	6
Thailand	6
Jordan	5
Italy	3
Georgia	3
Morocco	3
Syrian Arab Republic	3
Saudi Arabia	3
Tunisia	2
Indonesia	2
Armenia	1

Benchmarking education system

Massachusetts-USA	20
Dubai-UAE	16
North Carolina-USA	12
Colorado-USA	12
California-USA	11
Abu Dhabi-UAE	11
Florida-USA	11
Indiana-USA	10
Minnesota-USA	10
Connecticut-USA	9
Alberta-CAN	5
Alabama-USA	5
Quebec-CAN	5
Ontario-CAN	3

Percent higher than International average

Percent lower than International average

Classify element/compound/mixture (continued)

S042305:

Student Responses**Correct Response:**

The table below shows some elements, compounds, and mixtures.

Classify them by putting an X in the appropriate column beside each one.

	Element	Compound	Mixture
Air			X
Sugar		X	
Salt		X	
Gold	X		
Sea water			X
Helium	X		

Incorrect Response:

The table below shows some elements, compounds, and mixtures.

Classify them by putting an X in the appropriate column beside each one.

	Element	Compound	Mixture
Air		X	
Sugar			X
Salt			X
Gold	X		
Sea water			X
Helium	X		

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Knowing

Definition of a compound

Which of the following defines a compound?

- A. different substances mixed together
- B. atoms and molecules mixed together
- C. atoms of different elements combined together
- D. atoms of the same element combined together

Item Number: S042306

Correct Response:	C
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Overall Percent Correct

Education system	Percent correct
Singapore	66
Chinese Taipei-CHN	65
Russian Federation	59
Israel	56
Japan	55
Ukraine	54
Turkey	53
Palestinian Nat'l Auth.	53
Bahrain	52
Hungary	50
England-GBR	49
United Arab Emirates	49
Finland	48
Hong Kong-CHN	48
New Zealand	48
Jordan	47
United States	46
Slovenia	46
Korea, Rep. of	45
Saudi Arabia	45
Oman	42
International average	42
Qatar	41
Australia	39
Sweden	38
Syrian Arab Republic	37
Chile	37
Morocco	37
Norway	36
Italy	36
Lebanon	35
Ghana	34
Malaysia	33
Iran, Islamic Rep. of	32
Romania	31
Armenia	30
Thailand	27
Tunisia	25
Kazakhstan	22
Macedonia, Rep. of	21
Georgia	20
Indonesia	18
Lithuania	—

Benchmarking education system

Massachusetts-USA	58
Florida-USA	51
Dubai-UAE	51
North Carolina-USA	50
California-USA	48
Abu Dhabi-UAE	48
Colorado-USA	46
Indiana-USA	46
Connecticut-USA	45
Minnesota-USA	45
Alabama-USA	45
Quebec-CAN	34
Ontario-CAN	34
Alberta-CAN	30

Percent higher than International average

Percent lower than International average

— Not applicable

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Chemical Change	Knowing

Fire put out by blanket

Why can a small fire be put out by placing a heavy blanket over it?

- A. This lowers the temperature.
- B. This make the flames smaller.
- C. This absorbs the burning substance.
- D. This keeps oxygen from reaching the fire.

Item Number: S052046

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Finland	98
Korea, Rep. of	97
Slovenia	96
<i>Chinese Taipei-CHN</i>	95
Sweden	94
Norway	94
<i>Hong Kong-CHN</i>	93
Russian Federation	93
Hungary	92
Japan	91
Lithuania	90
Ukraine	90
Israel	89
Australia	89
New Zealand	88
Italy	88
<i>England-GBR</i>	88
Iran, Islamic Rep. of	87
Singapore	87
United States	85
Armenia	82
Chile	82
Romania	80
Kazakhstan	78
International average	78
Jordan	78
Syrian Arab Republic	75
Tunisia	75
<i>Palestinian Nat'l Auth.</i>	73
Saudi Arabia	72
Bahrain	69
Turkey	69
Georgia	69
Malaysia	67
United Arab Emirates	66
Qatar	66
Lebanon	61
Oman	58
Macedonia, Rep. of	56
Thailand	55
Morocco	49
Ghana	48
Indonesia	32

Benchmarking education system

Alberta-CAN	94
Quebec-CAN	94
Minnesota-USA	90
Ontario-CAN	89
Massachusetts-USA	89
Indiana-USA	88
Colorado-USA	87
Connecticut-USA	86
North Carolina-USA	83
Florida-USA	82
Alabama-USA	82
California-USA	79
Dubai-UAE	73
Abu Dhabi-UAE	65

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Reasoning

List two substances that are metal

Some physical properties of five different substances (A, B, C, D, and E) are outlined in the table below. Two of the substances are metal.

	Substance A	Substance B	Substance C	Substance D	Substance E
Physical state at room temperature (20°C)	solid	solid	liquid	liquid	gas
Appearance/color	shiny grey	white	silver	colorless	colorless
Conducts electricity	yes	no	yes	yes	no

List the two substances (A, B, C, D, or E) that are metal.

- 1.
- 2.

Item Number: S052136

SCORING

Correct Response

- Lists substances A and C.

Incorrect Response

- Lists substance A with an incorrect or no other substance listed.
 - Lists substance C with an incorrect or no other substance listed.
 - Other incorrect (including crossed out, erased, stray marks, illegible, or off task), including the following response:
1. Shiny grey
 2. Silver

Overall Percent Correct

Education system	Percent correct
Japan	76
Singapore	75
Chinese Taipei-CHN	71
Hong Kong-CHN	67
Israel	65
Slovenia	64
Korea, Rep. of	61
Hungary	61
England-GBR	60
Sweden	58
Finland	58
United States	57
Australia	57
New Zealand	55
Italy	55
Turkey	54
Russian Federation	53
Ukraine	46
Kazakhstan	45
Lithuania	45
Norway	44
International average	44
Lebanon	40
Thailand	40
Iran, Islamic Rep. of	39
Chile	39
United Arab Emirates	37
Qatar	34
Romania	33
Jordan	33
Malaysia	32
Bahrain	31
Macedonia, Rep. of	28
Tunisia	28
Palestinian Nat'l Auth.	27
Oman	26
Saudi Arabia	26
Armenia	25
Morocco	23
Syrian Arab Republic	21
Indonesia	18
Ghana	17
Georgia	15

Benchmarking education system

Massachusetts-USA	64
Colorado-USA	62
Connecticut-USA	61
North Carolina-USA	59
Florida-USA	59
Alberta-CAN	58
Ontario-CAN	58
Indiana-USA	56
Minnesota-USA	55
Quebec-CAN	55
California-USA	54
Alabama-USA	54
Dubai-UAE	53
Abu Dhabi-UAE	33

Percent higher than International average
 Percent lower than International average

List two substances that are metal (continued)

S052136:

Student Responses

Correct Response:

List the two substances (A, B, C, D, or E) that are metal.

1. A

2. C

Incorrect Response:

List the two substances (A, B, C, D, or E) that are metal.

1. Substance A

2. Substance B

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Classification and Composition of Matter	Applying

Atoms in a crushed can

A car tire runs over a can and crushes it completely.

Which statement is true for the atoms in the structure of the can?

- A. The atoms are broken.
- B. The atoms are flattened.
- C. The atoms remain the same.
- D. The atoms are changed into different atoms.

Item Number: S052152

Correct Response:	C
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Overall Percent Correct

Education system	Percent correct
Israel	66
Korea, Rep. of	65
<i>Chinese Taipei-CHN</i>	65
Singapore	61
Sweden	58
Finland	56
Russian Federation	55
United States	53
Japan	49
Hungary	47
Lithuania	47
Iran, Islamic Rep. of	46
Norway	45
Armenia	43
Slovenia	43
Turkey	41
<i>Hong Kong-CHN</i>	41
<i>England-GBR</i>	41
New Zealand	41
Kazakhstan	40
Chile	38
Australia	38
Romania	37
Ukraine	37
International average	37
Macedonia, Rep. of	36
Lebanon	32
Italy	30
Thailand	28
Georgia	27
United Arab Emirates	27
Bahrain	27
Syrian Arab Republic	24
Ghana	23
Saudi Arabia	21
Jordan	20
Morocco	20
Qatar	20
Oman	20
<i>Palestinian Nat'l Auth.</i>	19
Malaysia	15
Indonesia	11
Tunisia	9

Benchmarking education system

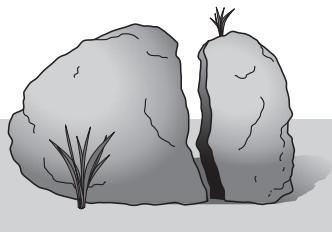
<i>Massachusetts-USA</i>	64
<i>Indiana-USA</i>	59
<i>Florida-USA</i>	59
<i>Minnesota-USA</i>	56
<i>Quebec-CAN</i>	54
<i>Colorado-USA</i>	54
<i>California-USA</i>	52
<i>North Carolina-USA</i>	51
<i>Connecticut-USA</i>	49
<i>Alberta-CAN</i>	45
<i>Ontario-CAN</i>	44
<i>Alabama-USA</i>	42
<i>Dubai-UAE</i>	35
<i>Abu Dhabi-UAE</i>	26

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
CHEMISTRY	Properties of Matter	Reasoning

Water splitting rock

Scientists think that the rocks in the picture were once a single rock.



Which property of water had the **most** effect on splitting the rock into two pieces?

- A. Water expanding when it freezes.
- B. Water boiling at 100°C.
- C. Water having a density less than rock.
- D. Water dissolving many substances.

Item Number: S052254

Correct Response:	A
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Overall Percent Correct**Benchmarking education system**

Massachusetts-USA	75
Minnesota-USA	69
Connecticut-USA	67
North Carolina-USA	66
Alberta-CAN	66
Florida-USA	63
Indiana-USA	56
Colorado-USA	54
Ontario-CAN	53
California-USA	46
Alabama-USA	44
Quebec-CAN	42
Dubai-UAE	40
Abu Dhabi-UAE	33

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Knowing

Energy conversion in a flashlight

Which of the following energy conversions takes place in a battery-operated flashlight?

- A. electrical → mechanical → light
- B. chemical → mechanical → light
- C. chemical → electrical → light
- D. nuclear → electrical → light

Item Number: S032024

Correct Response:	C
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Overall Percent Correct

Education system	Percent correct
Singapore	82
Hong Kong-CHN	79
Japan	55
England-GBR	51
New Zealand	51
Israel	49
Malaysia	44
Australia	41
Norway	40
Italy	39
Indonesia	38
United States	38
Qatar	37
Ghana	37
Saudi Arabia	36
Bahrain	36
Lebanon	35
Chinese Taipei-CHN	35
International average	35
Iran, Islamic Rep. of	35
United Arab Emirates	34
Russian Federation	33
Tunisia	33
Turkey	33
Palestinian Nat'l Auth.	32
Finland	31
Oman	31
Sweden	29
Chile	29
Armenia	27
Slovenia	25
Jordan	25
Kazakhstan	24
Hungary	24
Syrian Arab Republic	23
Thailand	22
Lithuania	21
Romania	20
Macedonia, Rep. of	20
Ukraine	20
Morocco	20
Georgia	18
Korea, Rep. of	—

Benchmarking education system

Florida-USA	45
Dubai-UAE	42
Minnesota-USA	41
Alberta-CAN	38
Colorado-USA	35
Massachusetts-USA	34
Indiana-USA	32
Alabama-USA	32
Connecticut-USA	31
Abu Dhabi-UAE	31
Ontario-CAN	30
North Carolina-USA	28
California-USA	26
Quebec-CAN	22

Percent higher than International average

Percent lower than International average

— Not applicable

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Forces and Motion	Applying

Gravity acting on parachute jumper

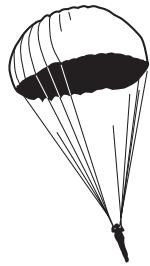
The figure shows a parachute jumper in four positions.



1. In the aircraft before the jump



2. In freefall immediately after jumping before parachute opens



3. Falling to the ground after the parachute opens



4. On the ground just after landing

In which of the positions does the force of gravity act on the jumper?

- A. Position 2 only.
- B. Positions 2 and 3 only.
- C. Positions 1, 2 and 3 only.
- D. Positions 1, 2, 3, and 4.

Item Number: S032141

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	63
Finland	59
Israel	54
Japan	49
Sweden	49
Slovenia	47
Singapore	45
Hungary	45
England-GBR	43
Lithuania	42
Ukraine	40
Russian Federation	38
United States	37
Hong Kong-CHN	36
Chinese Taipei-CHN	35
Turkey	34
Palestinian Nat'l Auth.	34
Norway	32
International average	32
Jordan	30
Armenia	30
Australia	30
New Zealand	29
United Arab Emirates	28
Italy	26
Qatar	26
Lebanon	26
Bahrain	25
Syrian Arab Republic	25
Ghana	22
Kazakhstan	22
Oman	22
Thailand	22
Iran, Islamic Rep. of	22
Romania	22
Saudi Arabia	20
Macedonia, Rep. of	20
Georgia	20
Chile	19
Morocco	16
Malaysia	16
Tunisia	16
Indonesia	13

Benchmarking education system

Connecticut-USA	51
Minnesota-USA	49
Alberta-CAN	44
Massachusetts-USA	43
Ontario-CAN	43
Florida-USA	42
Indiana-USA	38
North Carolina-USA	38
Colorado-USA	36
Quebec-CAN	33
California-USA	33
Alabama-USA	32
Dubai-UAE	27
Abu Dhabi-UAE	26

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Knowing

Molecules of gas when heated

A gas is heated and its temperature increases.

What happens to the gas molecules?

- A. They get bigger.
- B. They move faster.
- C. They move slower.
- D. They increase in number.

Item Number: S032158

Correct Response:	B
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Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	86
Israel	81
Russian Federation	80
Singapore	79
Norway	75
United States	75
Finland	73
Turkey	72
Hungary	71
Saudi Arabia	71
Sweden	69
Slovenia	69
England-GBR	67
Chinese Taipei-CHN	67
Chile	66
Ukraine	66
New Zealand	65
Kazakhstan	65
Australia	64
Italy	62
Iran, Islamic Rep. of	61
Bahrain	61
International average	60
Armenia	59
Hong Kong-CHN	59
Malaysia	58
United Arab Emirates	58
Oman	58
Lithuania	57
Georgia	55
Macedonia, Rep. of	54
Palestinian Nat'l Auth.	52
Qatar	52
Jordan	51
Japan	45
Indonesia	45
Ghana	44
Morocco	40
Lebanon	39
Romania	38
Tunisia	38
Syrian Arab Republic	37
Thailand	33

Benchmarking education system

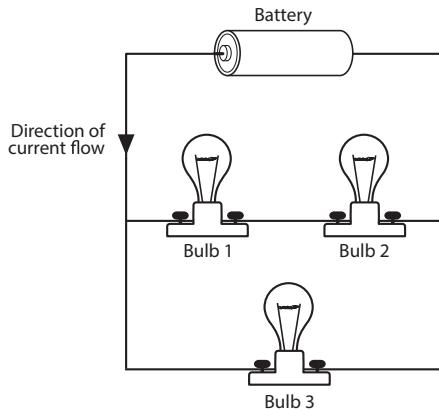
Massachusetts-USA	89
Alberta-CAN	86
Florida-USA	82
Indiana-USA	80
Colorado-USA	78
Ontario-CAN	77
Minnesota-USA	76
Connecticut-USA	72
California-USA	67
North Carolina-USA	67
Alabama-USA	64
Quebec-CAN	62
Dubai-UAE	61
Abu Dhabi-UAE	60

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Electricity and Magnetism	Applying

Bulbs in series/parallel circuit

Three identical light bulbs are connected to a battery as shown in the diagram. The arrow indicates the direction of the current flow.



Which statement is true?

- A. The current in Bulb 1 is greater than the current in Bulb 2.
- B. The current in Bulb 1 is greater than the current in Bulb 3.
- C. The current in Bulb 2 is the same as the current in Bulb 3.
- D. The current in Bulb 2 is the same as the current in Bulb 1.

Item Number: S032184

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	71
Singapore	68
Japan	62
Russian Federation	54
Hungary	52
United Arab Emirates	49
Israel	49
<i>Hong Kong-CHN</i>	49
Romania	48
Malaysia	47
Lebanon	47
Armenia	47
Turkey	46
Tunisia	46
Iran, Islamic Rep. of	45
<i>England-GBR</i>	45
Kazakhstan	45
Macedonia, Rep. of	44
Italy	43
Bahrain	43
International average	43
Australia	41
Saudi Arabia	41
United States	40
Sweden	40
Chile	40
Oman	40
<i>Palestinian Nat'l Auth.</i>	40
Jordan	39
Finland	38
New Zealand	37
Syrian Arab Republic	37
Qatar	37
Indonesia	36
Slovenia	35
Ukraine	35
Lithuania	34
Ghana	32
Georgia	31
Norway	31
Thailand	8
<i>Chinese Taipei-CHN</i>	—
Morocco	—

Benchmarking education system

<i>Abu Dhabi-UAE</i>	52
<i>Indiana-USA</i>	51
<i>Dubai-UAE</i>	49
<i>Florida-USA</i>	46
<i>Alabama-USA</i>	45
<i>California-USA</i>	42
<i>North Carolina-USA</i>	40
<i>Ontario-CAN</i>	39
<i>Connecticut-USA</i>	38
<i>Colorado-USA</i>	36
<i>Quebec-CAN</i>	36
<i>Alberta-CAN</i>	32
<i>Massachusetts-USA</i>	—
<i>Minnesota-USA</i>	—

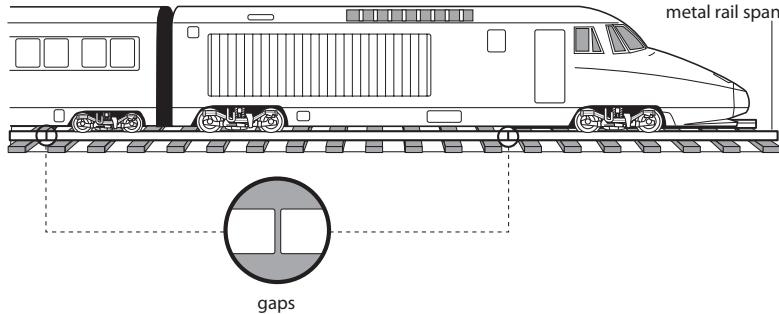
Percent higher than International average

Percent lower than International average

— Not applicable

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Applying

Gaps between metal rail spans



Which of the following best explains why some railroad tracks are laid down with gaps between the metal rail spans?

- A. To allow for the metal tracks to expand on hot days.
- B. To allow for the metal tracks to expand on cold days.
- C. To allow for cooling of the tracks by air in the gaps.
- D. To allow for vibration of the tracks due to the train.

Item Number: S032238

Correct Response:	A
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Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	87
Singapore	81
Hong Kong-CHN	76
Korea, Rep. of	62
Lithuania	61
Australia	60
Hungary	59
Malaysia	55
Finland	55
Japan	53
Turkey	52
Syrian Arab Republic	50
New Zealand	46
Palestinian Nat'l Auth.	44
Russian Federation	44
Sweden	43
Indonesia	43
Oman	43
Italy	42
International average	41
Qatar	40
Romania	40
United States	39
Bahrain	38
Saudi Arabia	38
Iran, Islamic Rep. of	37
England-GBR	37
Norway	35
Jordan	33
Tunisia	32
United Arab Emirates	31
Macedonia, Rep. of	30
Ukraine	29
Israel	28
Georgia	27
Slovenia	27
Thailand	26
Kazakhstan	22
Morocco	21
Ghana	20
Armenia	18
Lebanon	18
Chile	11

Benchmarking education system

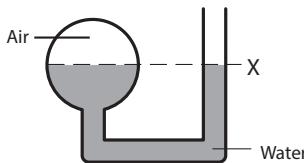
Alberta-CAN	60
Minnesota-USA	49
Massachusetts-USA	47
Indiana-USA	43
Ontario-CAN	42
Florida-USA	41
Connecticut-USA	40
North Carolina-USA	38
Abu Dhabi-UAE	37
Colorado-USA	34
Alabama-USA	32
Dubai-UAE	30
California-USA	27
Quebec-CAN	19

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Reasoning

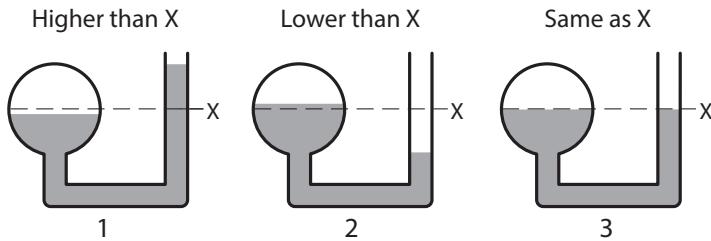
Water level in heated container

The figure shows a glass tube open at one end and connected to a closed glass sphere at the other end. The equipment is partly filled with water, as shown, so that there is air above the water in the sphere. The water in the tube reaches level X.



The air in the glass sphere is then heated by a hair dryer.

- A. What will be the water level in the open glass tube after the sphere is heated? (Circle 1, 2 or 3 below.)



- B. Explain your answer.

Item Number: S032272

SCORING

Correct Response

- HIGHER (1) with a correct explanation that refers to air expanding when heated or an increase in volume or pressure (or similar).

Examples:

When the sphere is heated, the air expands and pushes the water up the tube.

The pressure will make the water rise.

- Other correct

Incorrect Response

- HIGHER (1) with no explanation or an incorrect explanation.
- LOWER (2) with no explanation or an incorrect explanation.
- SAME (3) with no explanation or an incorrect explanation.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	45
Russian Federation	29
Korea, Rep. of	28
Kazakhstan	25
Chinese Taipei-CHN	24
Japan	23
Hong Kong-CHN	22
Israel	18
Slovenia	18
Hungary	17
Iran, Islamic Rep. of	17
Finland	15
Armenia	14
Sweden	14
Australia	13
Norway	13
International average	13
Bahrain	13
Chile	12
Lithuania	12
Turkey	11
New Zealand	11
Ukraine	11
Romania	11
United States	11
England-GBR	10
Malaysia	9
Macedonia, Rep. of	8
Syrian Arab Republic	8
Thailand	8
Indonesia	8
Jordan	8
Tunisia	8
Italy	8
Palestinian Nat'l Auth.	8
Oman	7
Lebanon	7
Georgia	7
Qatar	7
United Arab Emirates	7
Saudi Arabia	6
Morocco	4
Ghana	1

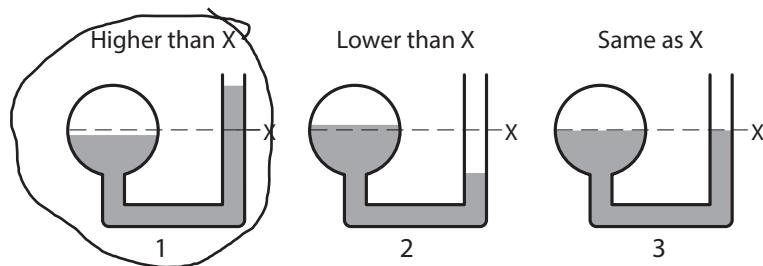
Benchmarking education system

Alberta-CAN	26
Ontario-CAN	24
Massachusetts-USA	16
Quebec-CAN	15
Colorado-USA	14
Connecticut-USA	14
Minnesota-USA	14
Florida-USA	13
Indiana-USA	12
North Carolina-USA	8
Abu Dhabi-UAE	8
Dubai-UAE	8
California-USA	6
Alabama-USA	6

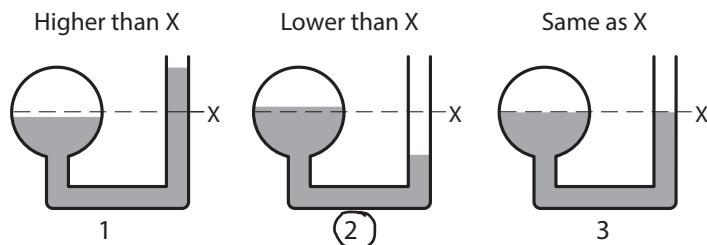
Percent higher than International average
 Percent lower than International average

Water level in heated container (continued)

S032272:

Student Responses**Correct Response:**

B. Explain your answer.

*air expands as it is heated***Incorrect Response:**

B. Explain your answer.

The heat will make water rise in the sphere.

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Forces and Motion	Applying

Why bottle collapses in the valley

A man climbed to the top of a very high mountain. While on the mountain top, he drank all the water in his plastic water bottle and then put the cover back on. When he returned to camp in the valley, he discovered that the empty bottle had collapsed.

Which of the following best explains why this happened?

- A. The temperature is lower in the valley than on the mountain top.
- B. The temperature is higher in the valley than on the mountain top.
- C. Air pressure in the valley is lower than on the mountain top.
- D. Air pressure in the valley is higher than on the mountain top.

Item Number: S032279

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Japan	57
Hong Kong-CHN	50
Slovenia	48
Russian Federation	44
Chinese Taipei-CHN	42
Turkey	41
Korea, Rep. of	40
United States	38
Israel	37
Sweden	37
England-GBR	36
Lithuania	36
Italy	36
Malaysia	35
New Zealand	35
Palestinian Nat'l Auth.	35
Australia	34
Hungary	34
Singapore	34
Norway	33
Thailand	33
International average	33
Bahrain	32
Armenia	31
Iran, Islamic Rep. of	30
Jordan	30
Finland	30
Ukraine	30
Kazakhstan	29
Tunisia	29
Qatar	28
Georgia	28
United Arab Emirates	28
Chile	28
Syrian Arab Republic	28
Indonesia	25
Oman	24
Saudi Arabia	24
Ghana	23
Lebanon	22
Macedonia, Rep. of	22
Romania	21
Morocco	21

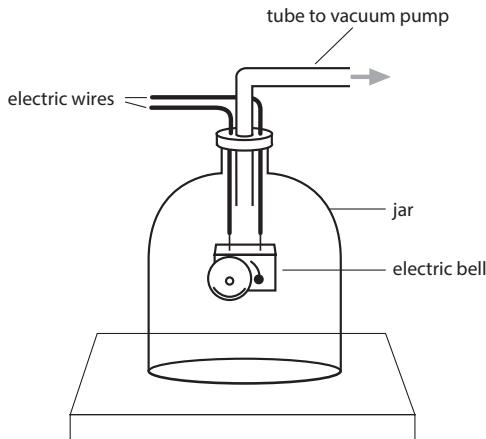
Benchmarking education system

Minnesota-USA	46
Massachusetts-USA	39
Connecticut-USA	39
Florida-USA	39
North Carolina-USA	38
Indiana-USA	36
Alberta-CAN	35
Colorado-USA	33
California-USA	33
Ontario-CAN	32
Alabama-USA	32
Dubai-UAE	31
Quebec-CAN	31
Abu Dhabi-UAE	29

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Light and Sound	Applying

Sound from electric bell in jar



The diagram shows an electric bell inside a jar. The electric bell is switched on and a ringing sound is heard. The air is then pumped out of the jar.

What will happen to the sound of the bell when the air is pumped out of the jar? Explain your answer.

Item Number: S032369

SCORING

Correct Response

- Refers to sound fading AND explains that sound needs a medium to travel through (or similar). Example: The sound will die out because if there is no air, then it cannot transfer the sound.
- Other fully correct

Partially Correct Response

- Refers to sound fading (or similar) with NO further explanation.
- Refers to sound fading with a minimal explanation that refers only to the vacuum or lack of air. [Does not explicitly refer to sound needing a medium to travel through.]
- Other partially correct

Incorrect Response

- Refers to sound disappearing (or similar) with an incorrect explanation that reflects a misconception about the production/transmission of sound.
- Refers to sound being louder, clearer (or similar) with or without further explanation.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	60
Japan	58
Hong Kong-CHN	44
Korea, Rep. of	40
Jordan	35
Turkey	33
Lithuania	33
Finland	32
Hungary	32
Slovenia	32
England-GBR	29
Russian Federation	28
Singapore	27
Palestinian Nat'l Auth.	27
Iran, Islamic Rep. of	26
Oman	24
Syrian Arab Republic	23
Ukraine	23
Armenia	22
International average	22
Kazakhstan	22
Sweden	21
Israel	19
United States	18
Australia	17
Italy	17
Bahrain	16
New Zealand	16
Macedonia, Rep. of	16
Georgia	15
Qatar	14
Malaysia	14
Tunisia	13
Norway	12
United Arab Emirates	12
Thailand	10
Lebanon	10
Saudi Arabia	10
Romania	7
Indonesia	6
Morocco	4
Ghana	4
Chile	3

Benchmarking education system

Florida-USA	27
Colorado-USA	23
Massachusetts-USA	21
Minnesota-USA	20
Dubai-UAE	20
Connecticut-USA	19
North Carolina-USA	16
Indiana-USA	16
Quebec-CAN	14
Alabama-USA	13
Ontario-CAN	11
Alberta-CAN	9
Abu Dhabi-UAE	8
California-USA	6

Percent higher than International average
 Percent lower than International average

Sound from electric bell in jar (continued)

S032369:

Student Responses

Correct Response:

less and less particles will be in the ~~jar~~ jar
causing the sound to dip and eventually stop
A vacume is formed in the jar so the particles
can't vibrate and carry sound

Partially Correct Response:

It will become silent.

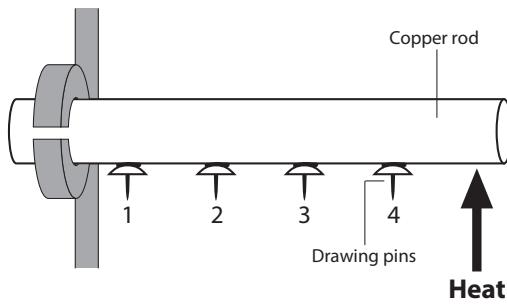
Incorrect Response:

The bell will stop because the
air gives pressure to a bell to move

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Applying

Heat conduction through copper rod

A student attaches four drawing pins to a copper rod using candle wax as shown in the diagram. The rod is then heated continuously at one end and the pins fall off in the order 4, 3, 2, 1.



By which process does heat reach the pins?

- A. expansion
- B. radiation
- C. conduction
- D. convection

Item Number: S032394

Correct Response:	C
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Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	91
Russian Federation	91
Ukraine	79
Kazakhstan	77
Japan	72
Singapore	72
Korea, Rep. of	70
Hong Kong-CHN	69
Armenia	66
Sweden	66
Hungary	63
Romania	62
Jordan	61
Macedonia, Rep. of	59
Oman	55
Palestinian Nat'l Auth.	54
Israel	53
International average	52
Iran, Islamic Rep. of	51
England-GBR	51
Lithuania	51
Finland	51
Chile	49
United Arab Emirates	49
Italy	48
Slovenia	48
Saudi Arabia	47
Turkey	46
Qatar	45
Malaysia	43
New Zealand	43
United States	41
Australia	41
Bahrain	40
Thailand	40
Ghana	40
Georgia	38
Indonesia	32
Lebanon	31
Norway	30
Syrian Arab Republic	25
Morocco	22
Tunisia	15

Benchmarking education system

Massachusetts-USA	55
Quebec-CAN	54
Dubai-UAE	54
Florida-USA	53
Minnesota-USA	48
Abu Dhabi-UAE	47
Indiana-USA	42
Alberta-CAN	42
California-USA	42
Connecticut-USA	40
Colorado-USA	40
North Carolina-USA	40
Alabama-USA	33
Ontario-CAN	32

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Physical States and Changes in Matter	Applying

Change-stay the same-DERIVED

As a liquid changes into a gas, which characteristics or properties change and which stay the same?

In each row of the table below, put an X in the appropriate column.

	Changes	Stays the Same
Density		
Mass		
Volume		
Size of molecules		
Speed of molecules		

Item Number: S042173Z

SCORING

Correct Response

- Places the X's correctly as shown below:

	Changes	Stays the Same
Density	X	
Mass		X
Volume	X	
Size of Molecules		X
Speed of Molecules	X	

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Israel	65
Korea, Rep. of	54
Japan	53
Singapore	49
Chinese Taipei-CHN	49
Ukraine	45
Slovenia	43
Russian Federation	43
Hong Kong-CHN	40
Turkey	40
Kazakhstan	40
Finland	38
England-GBR	37
Iran, Islamic Rep. of	36
United States	35
Chile	35
Norway	35
New Zealand	34
International average	34
Saudi Arabia	34
United Arab Emirates	33
Sweden	32
Bahrain	32
Armenia	31
Italy	31
Palestinian Nat'l Auth.	30
Hungary	30
Lithuania	30
Jordan	29
Oman	29
Qatar	28
Australia	28
Tunisia	26
Syrian Arab Republic	26
Macedonia, Rep. of	25
Georgia	24
Malaysia	23
Romania	22
Lebanon	22
Indonesia	18
Thailand	17
Ghana	9
Morocco	—

Benchmarking education system

Massachusetts-USA	54
Florida-USA	44
California-USA	43
Colorado-USA	42
Alberta-CAN	42
Minnesota-USA	39
Abu Dhabi-UAE	38
Indiana-USA	38
Connecticut-USA	37
Ontario-CAN	36
Dubai-UAE	32
North Carolina-USA	31
Quebec-CAN	26
Alabama-USA	25

Percent higher than International average

Percent lower than International average

— Not applicable

Change-stay the same (continued)

S042173Z:

Student Responses**Correct Response:**

	Changes	Stays the Same
Density	X	
Mass		X
Volume	X	
Size of molecules		X
Speed of molecules	X	

Incorrect Response:

	Changes	Stays the Same
Density	X	
Mass		X
Volume		X
Size of molecules		X
Speed of molecules	X	

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Electricity and Magnetism	Reasoning

Strength of a magnet

A student sets up an investigation to test the strength of magnets. He has several magnets of different sizes, shapes, and masses. He uses the magnets to lift metal paper clips.

How is the strength of a magnet defined in the investigation?

- A. by the mass of the magnet lifting the metal paper clips
- B. by the size of the magnet lifting the metal paper clips
- C. by the number of metal paper clips lifted by the magnet
- D. by the time the metal paper clips stay on the magnet

Item Number: S042197

Correct Response:	C
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Overall Percent Correct

Education system	Percent correct
Singapore	80
Slovenia	68
Korea, Rep. of	68
England-GBR	65
Japan	63
Chinese Taipei-CHN	60
Australia	58
United States	57
Russian Federation	55
Ukraine	54
New Zealand	54
Malaysia	50
Hong Kong-CHN	49
Qatar	42
Sweden	42
Finland	42
Bahrain	42
International average	42
Hungary	41
United Arab Emirates	38
Chile	38
Iran, Islamic Rep. of	38
Tunisia	37
Jordan	37
Oman	35
Italy	35
Israel	35
Syrian Arab Republic	34
Armenia	33
Norway	33
Palestinian Nat'l Auth.	33
Lithuania	33
Turkey	32
Thailand	32
Romania	31
Saudi Arabia	29
Macedonia, Rep. of	29
Kazakhstan	29
Lebanon	28
Morocco	27
Georgia	24
Ghana	23
Indonesia	17

Benchmarking education system

Alberta-CAN	67
Indiana-USA	62
Massachusetts-USA	62
Florida-USA	61
Minnesota-USA	61
Connecticut-USA	61
Colorado-USA	60
North Carolina-USA	55
Ontario-CAN	54
Alabama-USA	49
California-USA	49
Dubai-UAE	45
Quebec-CAN	42
Abu Dhabi-UAE	36

Percent higher than International average
 Percent lower than International average

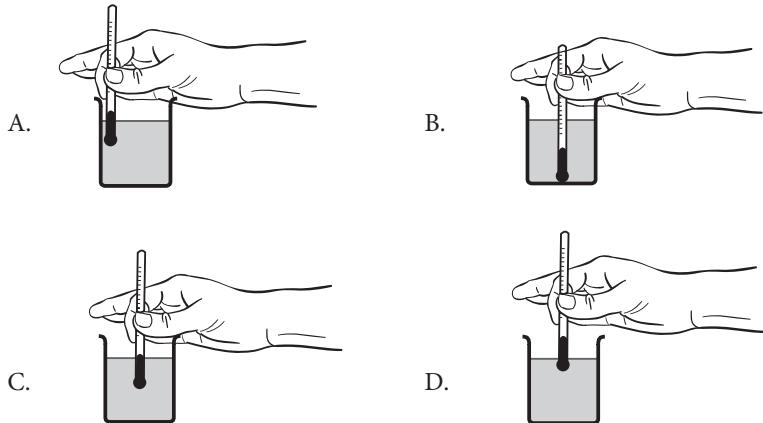
Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Knowing

Position of thermometer

Two kinds of heat sources are usually available in the science lab; an electric hot plate and a Bunsen burner. Jack planned an investigation to test which of these sources heats water faster.

He poured 200 mL of water into each of two identical beakers and recorded the initial temperature of the water in each beaker.

- A. Where should Jack place the thermometer to accurately take his readings during his investigation?



Item Number: S042238A

Correct Response:	C
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Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	71
Japan	64
Korea, Rep. of	60
Chinese Taipei-CHN	59
Finland	58
New Zealand	58
Norway	57
Australia	57
Russian Federation	53
Singapore	53
Slovenia	52
Sweden	52
Hungary	51
United States	48
England-GBR	48
Thailand	43
Italy	43
Palestinian Nat'l Auth.	43
Lithuania	43
International average	41
Ukraine	40
Malaysia	38
Israel	36
Romania	35
Oman	35
Turkey	35
United Arab Emirates	34
Qatar	33
Morocco	32
Bahrain	32
Lebanon	31
Kazakhstan	31
Jordan	31
Macedonia, Rep. of	31
Chile	31
Iran, Islamic Rep. of	28
Saudi Arabia	28
Syrian Arab Republic	28
Tunisia	25
Georgia	23
Armenia	23
Indonesia	22
Ghana	13

Benchmarking education system

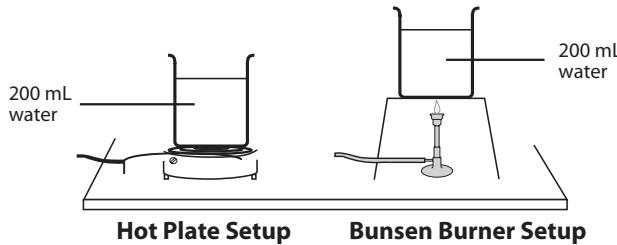
Quebec-CAN	66
Colorado-USA	60
Alberta-CAN	59
Minnesota-USA	58
Ontario-CAN	53
Massachusetts-USA	53
North Carolina-USA	52
Florida-USA	51
Indiana-USA	51
Connecticut-USA	50
Alabama-USA	43
California-USA	42
Dubai-UAE	42
Abu Dhabi-UAE	32

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Reasoning

One variable kept constant

Jack then placed one beaker on a hot plate and the other over a Bunsen burner, as shown below.



He recorded the temperature of the water in each set up every two minutes for ten minutes.

- B. List one variable that Jack controlled in his investigation.

Item Number: S042238B

SCORING

Correct Response

- Lists one variable as shown below.

The beakers (same, same shape, same size, same materials)

The water (same volume, from the same place)

The thermometer (same type, same position for taking readings)

Location of the experiment (same place, same room)

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Examples:

The initial temperature.

Checking the temperature.

Timing.

Overall Percent Correct

Education system	Percent correct
Japan	65
Singapore	60
England-GBR	49
Slovenia	43
Turkey	43
New Zealand	41
United States	39
Australia	38
Ukraine	32
Chinese Taipei-CHN	29
Israel	29
Hong Kong-CHN	29
Thailand	26
Jordan	23
Russian Federation	22
International average	21
Syrian Arab Republic	20
Lithuania	20
Oman	19
Malaysia	19
Hungary	18
United Arab Emirates	17
Georgia	16
Romania	14
Bahrain	13
Korea, Rep. of	11
Armenia	10
Iran, Islamic Rep. of	10
Qatar	9
Norway	9
Kazakhstan	8
Palestinian Nat'l Auth.	8
Morocco	8
Lebanon	8
Ghana	7
Tunisia	7
Finland	6
Chile	5
Macedonia, Rep. of	5
Indonesia	5
Italy	4
Saudi Arabia	3
Sweden	—

Benchmarking education system

Connecticut-USA	57
Colorado-USA	54
Alberta-CAN	54
Minnesota-USA	51
Florida-USA	48
Massachusetts-USA	45
Indiana-USA	36
North Carolina-USA	35
Ontario-CAN	30
California-USA	27
Dubai-UAE	24
Alabama-USA	20
Abu Dhabi-UAE	18
Quebec-CAN	9

Percent higher than International average
 Percent lower than International average

— Not applicable

One variable kept constant (continued)

S042238B:

Student Responses

Correct Response:

The amount of water

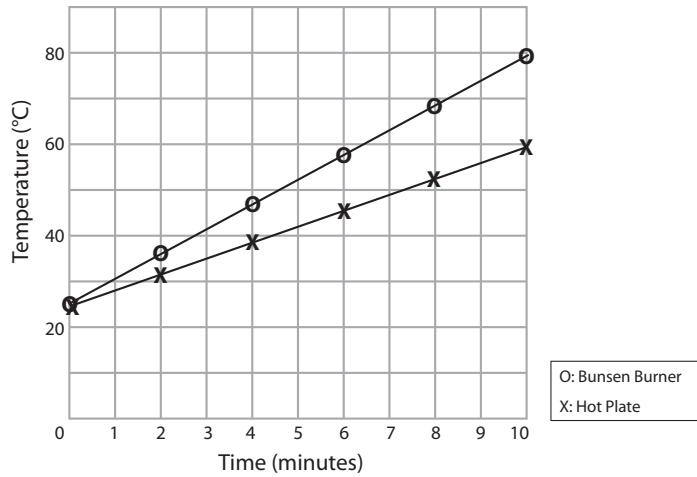
Incorrect Response:

Time

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Reasoning

Conclusion from the graph

C. Jack used his results to draw a graph as shown below.



Use the information in the graph to explain which heat source heated the water faster.

Item Number: S042238C

SCORING

Correct Response

- States that the Bunsen Burner heated the water faster than the hot plate.

Examples:

The bunsen burner heated faster because the temperature of the water after 10 minutes was higher than the temperature of the water being heated by the hot plate.

The bunsen burner heats up water at a faster rate than the hot plate.

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	91
Korea, Rep. of	90
Finland	90
Australia	88
United States	87
England-GBR	86
Japan	86
New Zealand	85
Chinese Taipei-CHN	85
Hungary	85
Lithuania	84
Hong Kong-CHN	82
Norway	80
Sweden	77
Israel	77
Italy	74
Russian Federation	71
Turkey	70
Chile	67
Ukraine	66
United Arab Emirates	66
Iran, Islamic Rep. of	65
International average	62
Tunisia	58
Malaysia	57
Jordan	57
Bahrain	56
Oman	52
Kazakhstan	50
Lebanon	49
Thailand	49
Saudi Arabia	49
Qatar	49
Palestinian Nat'l Auth.	47
Georgia	38
Romania	36
Macedonia, Rep. of	35
Morocco	35
Syrian Arab Republic	30
Indonesia	30
Armenia	26
Ghana	17
Slovenia	12

Benchmarking education system

Minnesota-USA	93
Massachusetts-USA	92
Indiana-USA	90
Colorado-USA	90
North Carolina-USA	88
Florida-USA	86
Connecticut-USA	86
California-USA	84
Ontario-CAN	83
Alberta-CAN	81
Alabama-USA	81
Dubai-UAE	74
Abu Dhabi-UAE	65
Quebec-CAN	43

Percent higher than International average
 Percent lower than International average

Conclusion from the graph (continued)

S042238C:

Student Responses

Correct Response:

The bunsen burner heated the water faster
On the graph the bunsen burner line is
increasing more quickly than the hot plate.
The end result showed the bunsen burner
had a higher temperature at the end of the
10 minutes.

Incorrect Response:

Hot plate, time is better for
same temperature

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Knowing

Molecules of liquid when it cools

What happens to the molecules of a liquid when the liquid cools?

- A. They slow down.
- B. They speed up.
- C. They decrease in number.
- D. They decrease in size.

Item Number: S042272

Correct Response:	A
-------------------	---

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	82
Slovenia	80
Russian Federation	77
Israel	75
Singapore	73
Finland	73
United States	73
Sweden	72
Kazakhstan	71
New Zealand	70
Hungary	70
Norway	68
Bahrain	67
Ukraine	67
<i>England-GBR</i>	65
Turkey	63
Saudi Arabia	63
Australia	62
United Arab Emirates	60
Iran, Islamic Rep. of	60
Armenia	59
Romania	59
Lithuania	59
International average	58
Georgia	56
Italy	56
<i>Chinese Taipei-CHN</i>	56
Malaysia	53
<i>Hong Kong-CHN</i>	52
Chile	51
Oman	50
Japan	50
Macedonia, Rep. of	49
Qatar	47
Jordan	46
Thailand	41
<i>Palestinian Nat'l Auth.</i>	40
Syrian Arab Republic	37
Lebanon	37
Indonesia	35
Morocco	33
Tunisia	32
Ghana	31

Benchmarking education system

Alberta-CAN	86
Massachusetts-USA	86
Ontario-CAN	83
Florida-USA	81
Indiana-USA	79
Minnesota-USA	79
Colorado-USA	76
Connecticut-USA	75
North Carolina-USA	71
California-USA	71
Alabama-USA	65
Quebec-CAN	65
Abu Dhabi-UAE	61
Dubai-UAE	59

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Light and Sound	Knowing

Speed of light through substances

Light travels fastest through which of the following?

- A. air
- B. glass
- C. water
- D. a vacuum

Item Number: S042274

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	64
Chinese Taipei-CHN	59
Singapore	54
Japan	53
Palestinian Nat'l Auth.	52
Turkey	50
Jordan	48
Oman	48
Saudi Arabia	47
Finland	44
Italy	44
Tunisia	41
Hungary	40
Morocco	40
Israel	40
Bahrain	38
Indonesia	36
Sweden	34
Russian Federation	33
International average	33
Hong Kong-CHN	31
Qatar	31
United Arab Emirates	30
Lebanon	30
Syrian Arab Republic	29
Chile	28
Thailand	28
Ukraine	27
Iran, Islamic Rep. of	26
Kazakhstan	25
Armenia	25
Ghana	24
Romania	24
England-GBR	21
Macedonia, Rep. of	19
New Zealand	18
Norway	17
Australia	16
Malaysia	15
Slovenia	14
United States	13
Lithuania	12
Georgia	11

Benchmarking education system

Quebec-CAN	34
Abu Dhabi-UAE	33
Dubai-UAE	24
Florida-USA	22
Connecticut-USA	18
California-USA	13
Alberta-CAN	13
Colorado-USA	13
Minnesota-USA	12
Massachusetts-USA	12
Indiana-USA	11
Alabama-USA	10
North Carolina-USA	9
Ontario-CAN	9

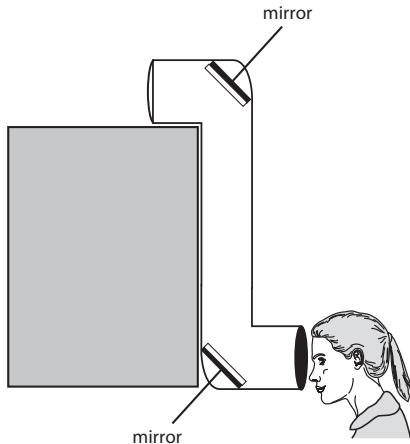
Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Light and Sound	Applying

Path of light through periscope

The diagram below shows a periscope. Mary is using it to look over a wall.

Draw the path the light ray would take through the periscope. Show the direction of the light ray with arrows.

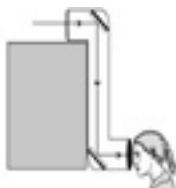


Item Number: S042278

SCORING

Correct Response

- Draws a correct path of the light ray with arrows showing the direction as shown below.



Incorrect Response

- Draws a correct path of the light ray, but arrows are missing.
- Draws a correct path of the light ray, but the direction is reversed.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Kazakhstan	57
Finland	53
Singapore	53
Hungary	50
Hong Kong-CHN	49
Slovenia	47
Russian Federation	46
England-GBR	42
Chinese Taipei-CHN	41
Sweden	40
Australia	39
Lithuania	39
Iran, Islamic Rep. of	38
Thailand	37
New Zealand	36
Italy	34
Romania	34
United States	34
Japan	33
Korea, Rep. of	32
Norway	32
International average	30
Israel	29
Armenia	26
Tunisia	26
Ukraine	25
Macedonia, Rep. of	24
Qatar	23
Syrian Arab Republic	23
Malaysia	22
Chile	22
United Arab Emirates	22
Bahrain	19
Lebanon	19
Turkey	19
Georgia	19
Oman	19
Palestinian Nat'l Auth.	18
Saudi Arabia	17
Morocco	16
Jordan	12
Indonesia	11
Ghana	5

Benchmarking education system

Minnesota-USA	49
Alberta-CAN	44
Indiana-USA	43
Massachusetts-USA	41
Quebec-CAN	40
Ontario-CAN	39
Colorado-USA	37
Connecticut-USA	36
Florida-USA	33
North Carolina-USA	31
Dubai-UAE	31
California-USA	29
Alabama-USA	26
Abu Dhabi-UAE	20

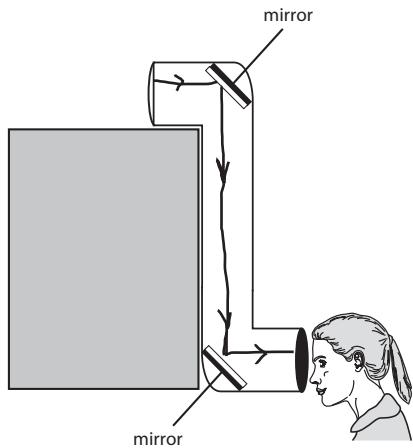
Percent higher than International average
 Percent lower than International average

Path of light through periscope (continued)

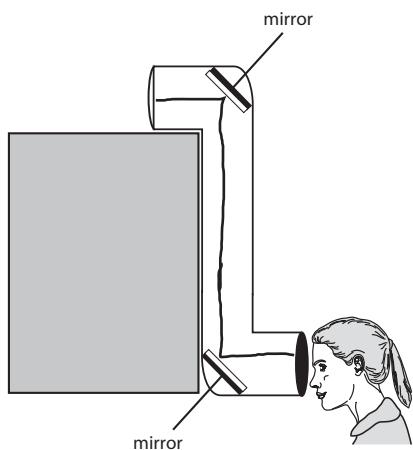
S042278:

Student Responses

Correct Response:

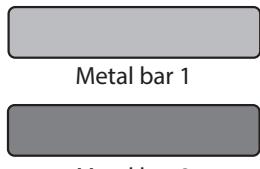


Incorrect Response:



Content Domain	Main Topic	Cognitive Domain
PHYSICS	Electricity and Magnetism	Reasoning

Find out if metal 2 is a magnet



Ray has two metal bars. He knows Metal bar 1 is a magnet.

A. How could he use Metal bar 1 to find out if Metal bar 2 is a magnet?

B. What would he observe if Metal bar 2 is a magnet?

Item Number: S042403

SCORING

Correct Response

- Refers to metals repelling each other. May or may not include attraction.

Examples:

Put one end of Metal 1 to both ends of Metal 2; If the metals repel, then Metal 2 is a magnet.

When either one of the ends goes near metal 2 it repels.

Incorrect Response

- Refers to attraction only.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	59
Korea, Rep. of	57
Finland	54
Hungary	51
Russian Federation	48
Sweden	45
Slovenia	40
Japan	39
Norway	38
Australia	38
Turkey	37
Lithuania	34
Ukraine	33
Chinese Taipei-CHN	33
Romania	32
Kazakhstan	32
United States	31
Iran, Islamic Rep. of	30
New Zealand	30
Israel	30
Italy	29
Chile	29
International average	28
Hong Kong-CHN	28
England-GBR	27
United Arab Emirates	27
Jordan	23
Bahrain	21
Palestinian Nat'l Auth.	21
Armenia	20
Malaysia	19
Qatar	18
Tunisia	16
Syrian Arab Republic	16
Macedonia, Rep. of	15
Thailand	13
Lebanon	12
Oman	12
Georgia	9
Indonesia	9
Morocco	7
Saudi Arabia	6
Ghana	3

Benchmarking education system

Colorado-USA	43
Minnesota-USA	40
Ontario-CAN	39
Massachusetts-USA	37
Indiana-USA	36
Alberta-CAN	35
Connecticut-USA	34
Quebec-CAN	34
Florida-USA	33
Dubai-UAE	31
Abu Dhabi-UAE	29
North Carolina-USA	27
Alabama-USA	25
California-USA	24

Percent higher than International average
 Percent lower than International average

Find out if metal 2 is a magnet (continued)

S042403:

Student Responses

Correct Response:

- A. How could he use Metal bar 1 to find out if Metal bar 2 is a magnet?

Ray could hold bar 1 near bar 2 if bar 2 is attracted to bar one and sticks to it, or if bar 1 repels bar 2, they're both magnets

- B. What would he observe if Metal bar 2 is a magnet?

Bar 2 would either be attracted and move towards and stick to bar 1, or be repelled and move away from bar 1

Incorrect Response:

- A. How could he use Metal bar 1 to find out if Metal bar 2 is a magnet?

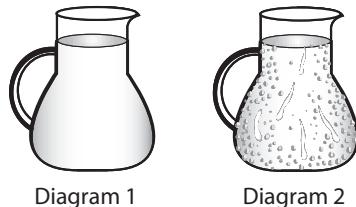
He could see if they stick together

- B. What would he observe if Metal bar 2 is a magnet?

the type of metal.

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Physical States and Changes in Matter	Applying

Liquid on outside of pitcher



Ice-cold water was placed in a glass pitcher on a hot day (Diagram 1). Soon afterwards, liquid appeared on the outside of the pitcher (Diagram 2).

Describe the process that caused the liquid to appear on the outside of the pitcher.

Item Number: S042404

SCORING

Correct Response

- Describes the process of condensation by referring to water vapor (in the air) condensing on the cool outside surface of the pitcher.

Example: It came from the water vapor condensing on the cool surface of a glass pitcher.

Partially Correct Response

- Describes the process of condensation by referring to water vapor (in the air) condensing without mentioning the coolness of the pitcher.

Example: The liquid came from water vapor condensing.

- States condensation without referring to water vapor.

Example: Condensation.

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Japan	35
Chinese Taipei-CHN	30
Singapore	22
Saudi Arabia	15
Kazakhstan	14
Israel	13
Hong Kong-CHN	13
Hungary	12
England-GBR	12
Korea, Rep. of	11
Sweden	11
Iran, Islamic Rep. of	10
Slovenia	8
International average	7
Norway	7
Bahrain	7
Australia	7
Finland	7
Qatar	6
Russian Federation	6
Jordan	5
United Arab Emirates	5
New Zealand	5
Romania	5
Palestinian Nat'l Auth.	4
Armenia	4
Turkey	4
Oman	4
Macedonia, Rep. of	3
Italy	3
Lebanon	3
United States	2
Malaysia	2
Georgia	2
Indonesia	2
Ukraine	2
Lithuania	2
Syrian Arab Republic	2
Chile	1
Thailand	1
Morocco	1
Ghana	1
Tunisia	#

Benchmarking education system

Ontario-CAN	10
Quebec-CAN	9
Alberta-CAN	7
Abu Dhabi-UAE	7
Massachusetts-USA	6
Dubai-UAE	5
Minnesota-USA	5
Connecticut-USA	4
Colorado-USA	4
North Carolina-USA	2
Florida-USA	2
Alabama-USA	2
Indiana-USA	1
California-USA	1

Percent higher than International average
 Percent lower than International average

Rounds to zero

Liquid on outside of pitcher (continued)

S042404:

Student Responses

Correct Response:

The water begins to evaporate because of the hot sun, the newly formed water vapor then condenses on the cool surface of the pitcher.

Partially Correct Response:

the water cooled
the glass causing water
vapor from the air to
condense on the glass

Incorrect Response:

The hot sun made the pitcher "sweat" causing it to bring out water.

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Applying

Which ice block will melt first

The pictures below show two ice blocks. Block 2 is wrapped in newspaper.



Ice Block 1



Ice Block 2 wrapped in newspaper

- A. Which ice block will melt first?

(Check one box.)

- Block 1
 Block 2

- B. Explain your answer.

Item Number: S042407

SCORING

Correct Response

- Block 1 with an explanation referring to heat OR surrounding air (hot air, sun) reaching ice block 1 more easily than ice block 2.

Examples:

Block 1 gains heat from the surrounding air. Block 2 does not gain much heat as it is wrapped in newspaper.

The newspaper helps to block some of the heat.

Incorrect Response

- Block 2 with an explanation referring explicitly or implicitly to the newspaper making the ice block warmer.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	60
Singapore	53
Japan	51
Ukraine	49
Chile	45
Tunisia	43
Korea, Rep. of	43
Slovenia	43
Hong Kong-CHN	42
Australia	41
Iran, Islamic Rep. of	39
Thailand	39
Romania	39
Kazakhstan	38
Bahrain	38
Hungary	38
England-GBR	38
Russian Federation	37
Indonesia	37
Jordan	36
Turkey	36
International average	35
New Zealand	34
Malaysia	34
Israel	34
Sweden	33
Syrian Arab Republic	33
Qatar	32
United States	31
Finland	31
Oman	31
Lithuania	30
United Arab Emirates	30
Norway	29
Palestinian Nat'l Auth.	28
Italy	28
Saudi Arabia	28
Ghana	24
Armenia	24
Georgia	22
Lebanon	20
Macedonia, Rep. of	18
Morocco	17

Benchmarking education system

Alberta-CAN	59
Ontario-CAN	49
Quebec-CAN	46
Minnesota-USA	36
Massachusetts-USA	34
Florida-USA	34
Abu Dhabi-UAE	31
Colorado-USA	31
Dubai-UAE	30
California-USA	28
North Carolina-USA	28
Connecticut-USA	28
Indiana-USA	28
Alabama-USA	20

Percent higher than International average
 Percent lower than International average

Which ice block will melt first (continued)

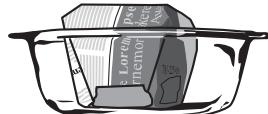
S042407:

Student Responses**Correct Response:**

The pictures below show two ice blocks. Block 2 is wrapped in newspaper.



Ice Block 1



Ice Block 2 wrapped in newspaper

A. Which ice block will melt first?

(Check one box.)

- Block 1
 Block 2

B. Explain your answer.

Newspaper is an insulator trapping the frigidness so remains solid longer.

Incorrect Response:

The pictures below show two ice blocks. Block 2 is wrapped in newspaper.



Ice Block 1



Ice Block 2 wrapped in newspaper

A. Which ice block will melt first?

(Check one box.)

- Block 1
 Block 2

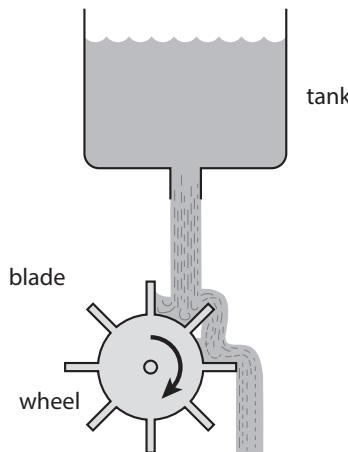
B. Explain your answer.

The paper will make it warmer in side & the ice melt faster ~~it will~~

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Knowing

Water wheel: Energy of tank water

The diagram shows water flowing from a tank and rotating a wheel.



- A. What kind of energy does the water have when it is in the tank?

Item Number: S052165A

SCORING

Correct Response

- (Gravitational) potential energy or gravitational energy or stored energy

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	64
Hong Kong-CHN	38
Israel	35
Saudi Arabia	33
Iran, Islamic Rep. of	33
United States	32
New Zealand	27
Russian Federation	26
Slovenia	24
Ukraine	24
Kazakhstan	23
Australia	22
Armenia	22
Ghana	19
Italy	19
Turkey	18
Lebanon	18
England-GBR	17
International average	17
Macedonia, Rep. of	15
Bahrain	15
Malaysia	14
Palestinian Nat'l Auth.	14
Lithuania	14
Finland	13
Qatar	13
Romania	13
United Arab Emirates	10
Sweden	10
Jordan	9
Indonesia	8
Japan	8
Korea, Rep. of	7
Norway	7
Syrian Arab Republic	7
Oman	6
Thailand	5
Georgia	5
Hungary	4
Chile	2
Tunisia	1
Chinese Taipei-CHN	1
Morocco	#

Benchmarking education system

Florida-USA	60
Colorado-USA	48
Massachusetts-USA	47
Connecticut-USA	40
Alabama-USA	32
Indiana-USA	30
Minnesota-USA	21
North Carolina-USA	18
Alberta-CAN	16
Dubai-UAE	14
Abu Dhabi-UAE	11
Ontario-CAN	11
California-USA	5
Quebec-CAN	2

Percent higher than International average
 Percent lower than International average

Rounds to zero

Water wheel: Energy of tank water (continued)

S052165A:

Student Responses

Correct Response:

Potential

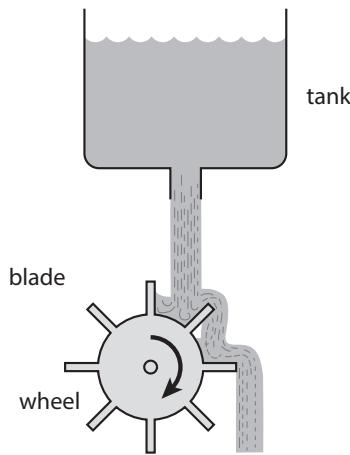
Incorrect Response:

fast energy.

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Knowing

Water wheel: Energy before wheel

The diagram shows water flowing from a tank and rotating a wheel.



- B. What kind of energy does the water have just before it hits the wheel?

Item Number: S052165B

SCORING

Correct Response

- Kinetic energy (with or without (gravitational) potential energy, or gravitational energy, or stored energy)

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	66
Hong Kong-CHN	60
Israel	47
Saudi Arabia	42
England-GBR	39
United States	37
Finland	37
Italy	34
Ukraine	31
Malaysia	31
New Zealand	31
Oman	31
Slovenia	29
Russian Federation	29
Turkey	28
Bahrain	27
Australia	27
Palestinian Nat'l Auth.	27
Iran, Islamic Rep. of	25
Kazakhstan	25
International average	24
Armenia	22
Qatar	21
Tunisia	21
Sweden	21
Ghana	20
Jordan	19
Lebanon	18
United Arab Emirates	18
Macedonia, Rep. of	16
Korea, Rep. of	15
Syrian Arab Republic	15
Romania	13
Lithuania	13
Japan	13
Indonesia	12
Hungary	11
Norway	9
Thailand	9
Chile	8
Georgia	4
Morocco	1
Chinese Taipei-CHN	1

Benchmarking education system

Florida-USA	63
Massachusetts-USA	54
Colorado-USA	52
Connecticut-USA	41
Indiana-USA	39
Alabama-USA	37
North Carolina-USA	27
Minnesota-USA	26
Alberta-CAN	23
Dubai-UAE	22
Abu Dhabi-UAE	20
Ontario-CAN	15
California-USA	10
Quebec-CAN	4

Percent higher than International average
 Percent lower than International average

Water wheel: Energy before wheel (continued)

S052165B:

Student Responses

Correct Response:

Kinetic

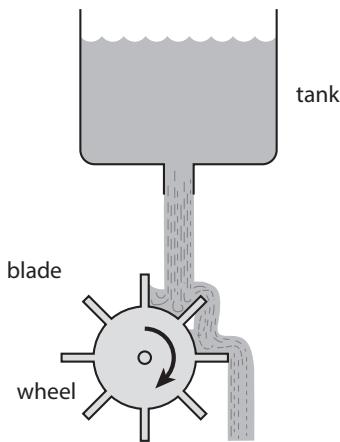
Incorrect Response:

Falling energy.
(dropping)

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Energy Transformations, Heat, and Temperature	Reasoning

Water wheel: Faster rotation

The diagram shows water flowing from a tank and rotating a wheel.



C. Write one change to the system that will make the wheel rotate faster.

Item Number: S052165C

SCORING

Correct Response

- Gives a reason related to increasing the flow of water from the list of acceptable responses below.

Put more water in the tank

Use a taller water tank

Make the outlet wider/bigger

Make another outlet

Increase the distance between the wheel and the tank

Make the wheel smaller

Make the blades wider/bigger/longer

Increase the number of blades

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task), including responses that do not include how to change the system.

Overall Percent Correct

Education system	Percent correct
Singapore	67
Japan	58
Hong Kong-CHN	46
Korea, Rep. of	44
Israel	44
Chinese Taipei-CHN	44
England-GBR	42
Finland	41
Iran, Islamic Rep. of	40
Turkey	37
Russian Federation	37
Australia	36
Slovenia	35
Hungary	34
Norway	31
Ukraine	31
Lithuania	31
New Zealand	29
United States	28
International average	27
Sweden	26
Syrian Arab Republic	25
Romania	25
Italy	23
Oman	23
Kazakhstan	20
Tunisia	20
Palestinian Nat'l Auth.	20
Bahrain	18
Jordan	18
United Arab Emirates	18
Saudi Arabia	17
Macedonia, Rep. of	17
Qatar	17
Malaysia	16
Armenia	16
Georgia	13
Chile	12
Lebanon	11
Thailand	10
Indonesia	9
Morocco	5
Ghana	3

Benchmarking education system

Massachusetts-USA	37
Minnesota-USA	35
Alberta-CAN	35
Colorado-USA	33
Connecticut-USA	33
Ontario-CAN	32
Quebec-CAN	31
Indiana-USA	25
Florida-USA	25
Dubai-UAE	24
North Carolina-USA	23
Alabama-USA	17
California-USA	17
Abu Dhabi-UAE	17

Percent higher than International average
 Percent lower than International average

Water wheel: Faster rotation (continued)

S052165C:

Student Responses

Correct Response:

more water coming out at
once ; a bigger opening

Incorrect Response:

Changing the Speed and temperature of the
Water.

Content Domain	Main Topic	Cognitive Domain
PHYSICS	Forces and Motion	Knowing

In which liquid would object float

An object has a density of 1.1 g/cm³.

- A. In which liquid would this object float?

(Check one box.)

- Liquid X: 1.3 g/cm³
 Liquid Y: 0.9 g/cm³

- B. Explain your answer.

Item Number: S052207

SCORING

Correct Response

- Liquid X with an explanation that refers to the object being less dense.

Examples:

Liquid X – The density of the object is lower than the density of liquid X, so it can float in liquid X.

Liquid X – In order for the object to float, it must have a lower density than the liquid.

Incorrect Response

- Liquid X with an explanation that refers to the object/liquid being heavier or lighter.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	62
Singapore	61
Slovenia	58
<i>Chinese Taipei-CHN</i>	52
Hungary	48
Russian Federation	47
<i>Hong Kong-CHN</i>	45
Finland	44
United States	43
Japan	39
Turkey	38
Israel	36
Ukraine	36
Romania	35
Kazakhstan	35
Lithuania	35
Thailand	33
Jordan	32
International average	31
United Arab Emirates	30
Tunisia	30
<i>England-GBR</i>	29
Australia	28
Oman	28
Italy	28
Sweden	27
Armenia	26
New Zealand	25
Lebanon	24
<i>Palestinian Nat'l Auth.</i>	23
Malaysia	23
Norway	23
Georgia	22
Bahrain	21
Iran, Islamic Rep. of	21
Chile	19
Qatar	17
Saudi Arabia	16
Morocco	15
Syrian Arab Republic	15
Macedonia, Rep. of	12
Ghana	9
Indonesia	9

Benchmarking education system

Massachusetts-USA	66
Colorado-USA	53
Connecticut-USA	52
Minnesota-USA	51
Alberta-CAN	50
North Carolina-USA	49
California-USA	48
Ontario-CAN	45
Indiana-USA	45
Florida-USA	43
Quebec-CAN	35
Dubai-UAE	35
Alabama-USA	33
Abu Dhabi-UAE	29

Percent higher than International average
 Percent lower than International average

In which liquid would object float (continued)

S052207:

Student Responses

Correct Response:

A. In which liquid would this object float?

(Check one box.)

Liquid X: 1.3 g/cm^3

Liquid Y: 0.9 g/cm^3

B. Explain your answer.

The object has to be less dense than the liquid.

Incorrect Response:

A. In which liquid would this object float?

(Check one box.)

Liquid X: 1.3 g/cm^3

Liquid Y: 0.9 g/cm^3

B. Explain your answer.

Because the liquid is lighter than the object.

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Processes, Cycles, and History	Applying

Order of steps in the water cycle

The following five statements describe processes involved in the water cycle. Water evaporation from the sea is identified as a first step in the water cycle.

Number the other statements 2 through 5 in the order in which these processes take place.

- _____ Water vapor rises in warm air.
- _____ Water travels along a river to the sea.
- 1 Water evaporates from the sea.
- _____ Water vapor is cooled and forms clouds.
- _____ Clouds move and water falls on land as rain.

Item Number: S032060

SCORING

Correct Response

- 2, 5, 1, 3, 4

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Finland	92
Hong Kong-CHN	85
Singapore	83
Chinese Taipei-CHN	82
Korea, Rep. of	81
Russian Federation	79
England-GBR	79
Israel	79
Sweden	78
Lithuania	76
Slovenia	76
Hungary	74
New Zealand	72
Australia	71
Italy	71
United States	71
Japan	71
Ukraine	69
Norway	67
Chile	66
International average	63
Tunisia	62
United Arab Emirates	62
Thailand	61
Oman	60
Bahrain	59
Iran, Islamic Rep. of	58
Jordan	57
Romania	56
Saudi Arabia	56
Kazakhstan	55
Georgia	54
Turkey	54
Lebanon	50
Malaysia	49
Armenia	47
Syrian Arab Republic	46
Palestinian Nat'l Auth.	45
Indonesia	45
Qatar	45
Morocco	44
Macedonia, Rep. of	37
Ghana	14

Benchmarking education system

Quebec-CAN	80
Minnesota-USA	79
Alberta-CAN	77
Ontario-CAN	76
Massachusetts-USA	76
North Carolina-USA	76
Colorado-USA	75
Indiana-USA	74
Florida-USA	73
Dubai-UAE	68
Connecticut-USA	67
California-USA	62
Abu Dhabi-UAE	60
Alabama-USA	58

Percent higher than International average
 Percent lower than International average

Order of steps in the water cycle (continued)

S032060:

Student Responses

Correct Response:

- 2 Water vapor rises in warm air.
- 5 Water travels along a river to the sea.
- 1 Water evaporates from the sea.
- 3 Water vapor is cooled and forms clouds.
- 4 Clouds move and water falls on land as rain.

Incorrect Response:

- 4 Water vapor rises in warm air.
- 2 Water travels along a river to the sea.
- 1 Water evaporates from the sea.
- 3 Water vapor is cooled and forms clouds.
- 5 Clouds move and water falls on land as rain.

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Processes, Cycles, and History	Knowing

Volcanic eruption effects

State one way that a volcanic eruption can affect the environment.

Overall Percent Correct

Education system	Percent correct
Singapore	81
Slovenia	78
Sweden	76
Finland	71
New Zealand	70
Lithuania	70
England-GBR	67
Russian Federation	63
Japan	63
Australia	63
United States	62
Chile	62
Korea, Rep. of	58
Kazakhstan	58
Romania	57
Chinese Taipei-CHN	55
Hong Kong-CHN	54
Hungary	54
Norway	49
Turkey	49
Israel	49
Ukraine	49
International average	48
Thailand	47
Indonesia	45
Saudi Arabia	45
United Arab Emirates	42
Italy	41
Iran, Islamic Rep. of	37
Georgia	34
Armenia	32
Bahrain	32
Jordan	32
Qatar	32
Malaysia	32
Macedonia, Rep. of	31
Palestinian Nat'l Auth.	31
Lebanon	28
Tunisia	28
Syrian Arab Republic	27
Oman	26
Morocco	19
Ghana	9

Item Number: S032126

SCORING

Correct Response

- States a negative environmental effect due to volcanic eruptions such as pollution (due to release of gases, smoke, ash, etc.) or destruction of habitats or plant/animal life (due to lava flow, burning or similar).

Example: Burns away essential plant life.

- States a positive environmental effect such as making land fertile, creating new habitats, and allowing for different life forms.

Example: It can make the land surrounding the volcano more fertile.

- Other correct

Incorrect Response

- Gives only a general statement of destruction or the nature of volcanic eruptions with inadequate description of how the environment is affected.

Example: It can destroy everything.

- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Benchmarking education system

Massachusetts-USA	70
Ontario-CAN	67
Colorado-USA	67
Connecticut-USA	65
Minnesota-USA	65
Florida-USA	64
Alberta-CAN	61
Indiana-USA	59
California-USA	58
North Carolina-USA	57
Quebec-CAN	56
Dubai-UAE	51
Alabama-USA	46
Abu Dhabi-UAE	39

Percent higher than International average
 Percent lower than International average

Volcanic eruption effects (continued)

S032126:

Student Responses

Correct Response:

the ash can give minerals to the
Soil

Incorrect Response:

Smoke/gases

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth in the Solar System and the Universe	Knowing

Major cause of tides

Which of the following is the major cause of tides?

- A. heating of the oceans by the Sun
- B. gravitational pull of the Moon
- C. earthquakes on the ocean floor
- D. changes in wind direction

Item Number: S032151

Correct Response:	B
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Overall Percent Correct

Education system	Percent correct
Finland	78
Slovenia	76
New Zealand	66
United States	61
Norway	59
Sweden	58
Italy	57
Australia	57
Russian Federation	56
Korea, Rep. of	55
<i>Chinese Taipei-CHN</i>	54
Iran, Islamic Rep. of	53
Lithuania	53
Oman	52
<i>England-GBR</i>	52
Syrian Arab Republic	50
United Arab Emirates	50
<i>Hong Kong-CHN</i>	45
Japan	44
Jordan	44
International average	43
Ukraine	42
Singapore	42
Thailand	41
Armenia	40
Chile	39
Bahrain	39
Qatar	38
Saudi Arabia	37
Israel	37
Turkey	35
Hungary	35
Kazakhstan	34
Macedonia, Rep. of	32
Indonesia	29
Georgia	25
Romania	25
<i>Palestinian Nat'l Auth.</i>	23
Morocco	18
Ghana	16
Malaysia	16
Tunisia	15
Lebanon	13

Benchmarking education system

Massachusetts-USA	79
Connecticut-USA	75
Florida-USA	70
Minnesota-USA	66
Colorado-USA	66
North Carolina-USA	61
Indiana-USA	57
Alberta-CAN	54
Quebec-CAN	51
Abu Dhabi-UAE	51
California-USA	50
Dubai-UAE	49
Alabama-USA	44
Ontario-CAN	38

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth in the Solar System and the Universe	Knowing

Difference between planets and moons

What is the main difference between planets and moons in our solar system?

- A. All planets can support life; moons cannot.
- B. All planets have atmospheres; moons do not.
- C. All planets orbit the Sun; all moons orbit planets.
- D. All planets are larger than all moons.

Item Number: S032160

Correct Response:	C
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Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	88
Finland	81
Hong Kong-CHN	79
Singapore	78
England-GBR	76
Russian Federation	75
Slovenia	75
Sweden	74
Kazakhstan	73
Norway	73
Chinese Taipei-CHN	71
New Zealand	70
Australia	70
United States	70
Lithuania	69
Italy	67
Turkey	66
Hungary	64
Ukraine	64
Chile	63
Israel	62
International average	62
Macedonia, Rep. of	60
Romania	59
United Arab Emirates	59
Bahrain	58
Qatar	58
Armenia	57
Palestinian Nat'l Auth.	54
Syrian Arab Republic	53
Malaysia	53
Japan	52
Iran, Islamic Rep. of	52
Saudi Arabia	52
Morocco	52
Thailand	51
Tunisia	49
Jordan	49
Georgia	49
Oman	46
Lebanon	44
Indonesia	39
Ghana	36

Benchmarking education system

Massachusetts-USA	77
Minnesota-USA	75
Florida-USA	73
North Carolina-USA	72
Indiana-USA	72
Alberta-CAN	72
Colorado-USA	71
Connecticut-USA	71
Alabama-USA	69
Quebec-CAN	69
Ontario-CAN	66
California-USA	66
Dubai-UAE	63
Abu Dhabi-UAE	60

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Resources, Their Use and Conservation	Knowing

Soil change due to natural causes

Soils change both through natural processes and as a result of human activity.
Which of the following soil changes is due only to natural causes?

- A. degradation of nutrients due to pesticides
- B. formation of deserts due to tree felling
- C. flooding due to dam construction
- D. removal of nutrients due to heavy rains

Item Number: S032463

Correct Response:

D

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	85
Finland	80
Japan	80
Russian Federation	77
Korea, Rep. of	77
Hong Kong-CHN	74
Hungary	73
Singapore	69
Turkey	67
Israel	67
Ukraine	67
Italy	66
Chile	66
Australia	64
United States	63
England-GBR	62
Thailand	61
Iran, Islamic Rep. of	60
Lithuania	59
International average	55
Georgia	55
New Zealand	54
Kazakhstan	54
Sweden	52
Bahrain	51
Armenia	50
United Arab Emirates	50
Romania	49
Slovenia	49
Indonesia	48
Palestinian Nat'l Auth.	43
Syrian Arab Republic	43
Qatar	41
Saudi Arabia	39
Malaysia	39
Tunisia	38
Ghana	38
Macedonia, Rep. of	38
Norway	35
Oman	35
Lebanon	34
Jordan	34
Morocco	28

Benchmarking education system

North Carolina-USA	75
Quebec-CAN	74
Massachusetts-USA	72
Minnesota-USA	71
Alberta-CAN	68
Indiana-USA	65
Ontario-CAN	65
Florida-USA	65
Connecticut-USA	63
Colorado-USA	63
Dubai-UAE	57
California-USA	55
Alabama-USA	49
Abu Dhabi-UAE	45

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Resources, Their Use and Conservation	Knowing

Material that breaks down quickly

The following waste materials are buried in a landfill.

Which will break down most quickly?

- A. steel
- B. plastic
- C. glass
- D. paper

Item Number: S032510

Correct Response:

D

Overall Percent Correct

Education system	Percent correct
Finland	91 ▲
Slovenia	90 ▲
Lithuania	88 ▲
<i>Chinese Taipei-CHN</i>	87 ▲
Hungary	87 ▲
<i>Hong Kong-CHN</i>	84 ▲
Thailand	83 ▲
Sweden	82 ▲
Korea, Rep. of	81 ▲
Romania	80 ▲
Indonesia	79 ▲
Russian Federation	79 ▲
Singapore	79 ▲
Ukraine	77 ▲
New Zealand	75 ▲
Japan	75 ▲
Australia	75 ▲
United States	74 ▲
<i>England-GBR</i>	73 ▲
Armenia	73 ▲
Italy	72 ▲
Kazakhstan	72
Macedonia, Rep. of	71
Georgia	70
Norway	70
Chile	69
International average	68
Israel	67
Turkey	66
Syrian Arab Republic	64
Malaysia	61 ▼
Tunisia	60 ▼
Jordan	58 ▼
Iran, Islamic Rep. of	57 ▼
United Arab Emirates	50 ▼
<i>Palestinian Nat'l Auth.</i>	49 ▼
Bahrain	46 ▼
Saudi Arabia	46 ▼
Lebanon	45 ▼
Oman	44 ▼
Morocco	43 ▼
Qatar	42 ▼
Ghana	32 ▼

Benchmarking education system

Alberta-CAN	82 ▲
Massachusetts-USA	82 ▲
Minnesota-USA	79 ▲
Colorado-USA	79 ▲
North Carolina-USA	78 ▲
Florida-USA	78 ▲
Indiana-USA	77 ▲
Connecticut-USA	76 ▲
Ontario-CAN	75 ▲
Quebec-CAN	73 ▲
Alabama-USA	71
California-USA	61 ▼
Dubai-UAE	51 ▼
Abu Dhabi-UAE	49 ▼

▲ Percent higher than International average
▼ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Structure and Physical Features	Applying

Changes at high elevations-DERIVED

Tamora is preparing to climb one of the highest mountains on Earth. She knows that the atmospheric conditions will change the higher up the mountain she climbs.

In the table below, write down two atmospheric conditions that will change as Tamora climbs the mountain. State what Tamora needs to bring in order to survive these two conditions at high elevations.

	Change in Atmospheric Condition	What Tamora Needs to Bring
1.		
2.		

Item Number: S032650Z

SCORING

Note: Each of the two responses are scored separately. However, if the two responses are essentially the same, the second response should be scored as "Incorrect Response".

Correct Response

- Indicates that the temperature will decrease (or similar).
Example: The temperature will be colder. [More clothes.]
- Indicates that there will be less oxygen (air) or lower atmospheric pressure (or similar).
Example: Air will get thinner. [Oxygen mask.]
- Indicates increased precipitation (snow, rain) or clouds (or similar).
Example: It will get icy. [Bring ice shoes.]
- Other correct

Incorrect Response

- Mentions a type of equipment, but does not clearly indicate how the atmospheric condition changes.
- Mentions that the atmospheric pressure increases with or without listing oxygen equipment.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task).

Overall Percent Correct

Education system	Percent correct
Singapore	61
Japan	60
New Zealand	59
Finland	59
England-GBR	56
Australia	56
Hungary	55
Korea, Rep. of	53
Chinese Taipei-CHN	50
Slovenia	49
Lithuania	48
Israel	46
United States	42
Hong Kong-CHN	40
Norway	40
Sweden	39
Saudi Arabia	37
International average	33
Romania	32
Russian Federation	32
Jordan	31
Palestinian Nat'l Auth.	31
United Arab Emirates	30
Italy	30
Tunisia	29
Kazakhstan	27
Qatar	26
Syrian Arab Republic	22
Chile	22
Bahrain	22
Macedonia, Rep. of	21
Morocco	20
Turkey	20
Oman	20
Iran, Islamic Rep. of	19
Ukraine	18
Armenia	15
Thailand	14
Malaysia	11
Indonesia	11
Georgia	10
Lebanon	9
Ghana	3

Benchmarking education system

Massachusetts-USA	60
Minnesota-USA	57
Quebec-CAN	56
Alberta-CAN	53
North Carolina-USA	52
Indiana-USA	51
Connecticut-USA	50
Colorado-USA	49
Ontario-CAN	48
Florida-USA	42
Dubai-UAE	39
Abu Dhabi-UAE	31
California-USA	30
Alabama-USA	29

Percent higher than International average
 Percent lower than International average

Changes at high elevations (continued)

S032650Z:

Student Responses**Correct Response:**

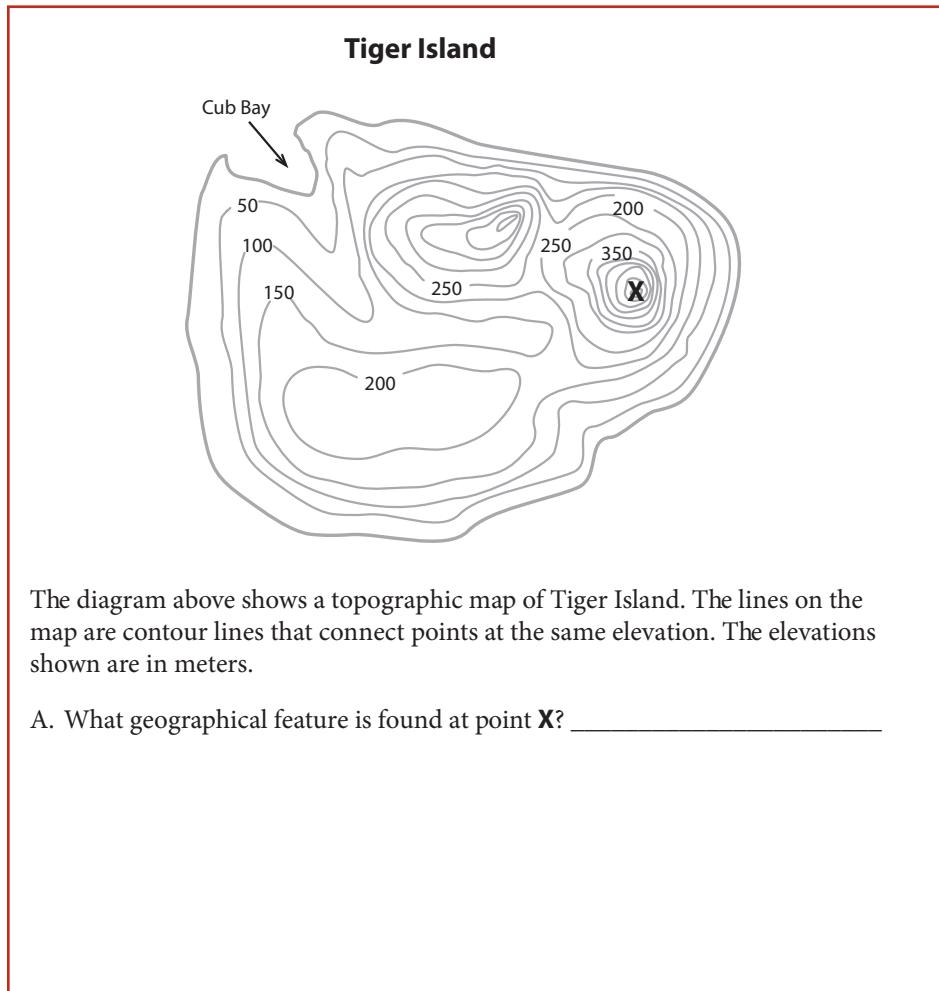
	Change in Atmospheric Condition	What Tamora Needs to Bring
1.	The air will become less Dense making it harder to breath	Oxygen tanks so she can breath
2.	It will get much colder the higher she goes	the warm weather Proof clothing

Incorrect Response:

	Change in Atmospheric Condition	What Tamora Needs to Bring
1.	The higher she goes the atmospheric condition is cooler changing.	Something she can use to stay to the top.
2.		

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Structure and Physical Features	Applying

Topographic map: identify X



Item Number: S032651A

SCORING**Correct Response**

- Identifies X as a mountain, hill, peak, summit, highest point, volcano, or similar.

Incorrect Response

- Identifies X as a crater, valley, hole, or similar (misinterpretation that contour lines indicate decreasing elevation).
- Identifies X as a water feature.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Finland	84
Chinese Taipei-CHN	81
Slovenia	70
Singapore	68
Russian Federation	67
Hungary	66
Hong Kong-CHN	64
Norway	61
Australia	61
Lithuania	60
Korea, Rep. of	60
United States	59
Ukraine	57
England-GBR	56
Italy	54
Japan	52
Israel	47
New Zealand	45
Sweden	43
International average	38
Kazakhstan	35
Iran, Islamic Rep. of	31
Turkey	31
Romania	30
Macedonia, Rep. of	28
Malaysia	27
Georgia	25
United Arab Emirates	23
Thailand	22
Chile	22
Saudi Arabia	22
Jordan	21
Bahrain	21
Armenia	20
Qatar	18
Syrian Arab Republic	17
Palestinian Nat'l Auth.	15
Lebanon	11
Morocco	10
Tunisia	10
Indonesia	9
Oman	9
Ghana	4

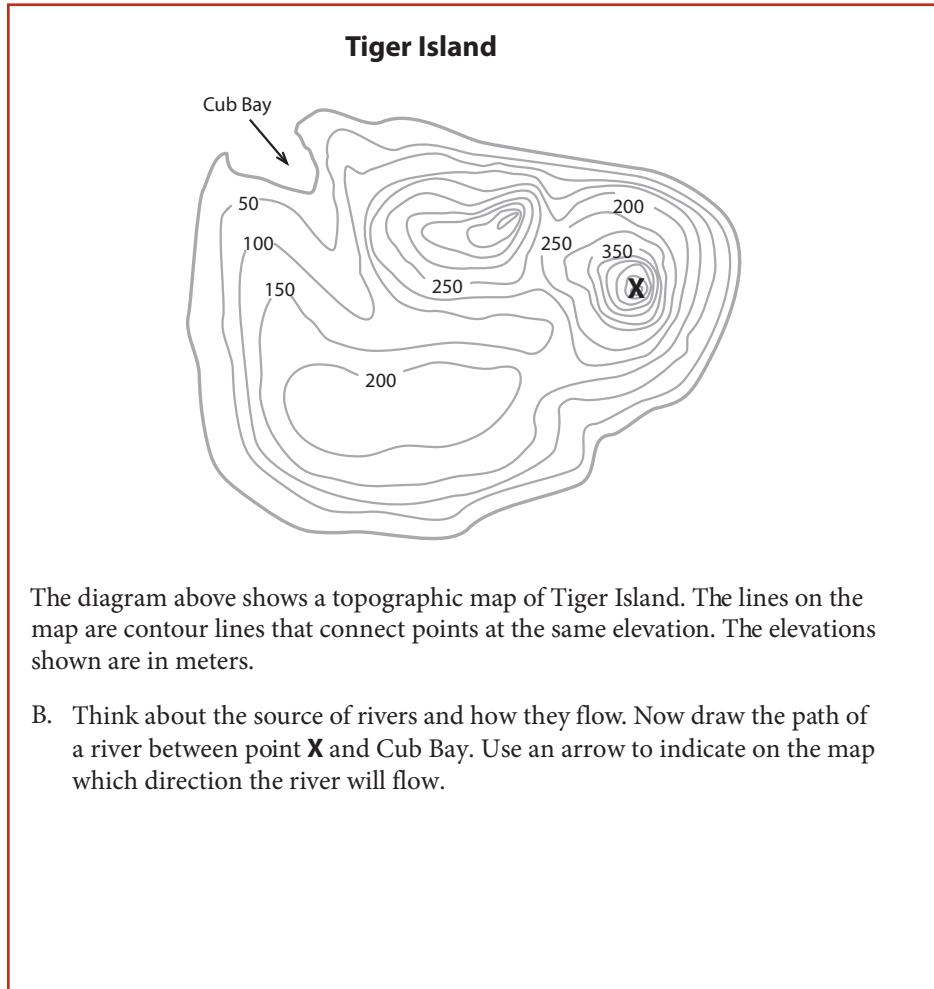
Benchmarking education system

Massachusetts-USA	82
Minnesota-USA	70
Colorado-USA	65
North Carolina-USA	63
Indiana-USA	61
Connecticut-USA	60
Alberta-CAN	58
Quebec-CAN	57
Florida-USA	51
Ontario-CAN	50
California-USA	45
Alabama-USA	38
Dubai-UAE	30
Abu Dhabi-UAE	23

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Structure and Physical Features	Reasoning

Topographic map: river path



Item Number: S032651B

SCORING**Correct Response**

- Draws a correct path WITH arrow(s) indicating correct direction (see diagram below).
[Path runs from point X downhill to Cub Bay and between the smaller hill(s). Includes arrow(s) that indicates direction of flow from mountain to the sea.]
- Draws a correct path (as described in first bullet) but OPPOSITE direction of arrow is shown (from sea to mountain).
- Draws a correct path (as described in first bullet) but NO arrow is shown.
- Other correct

Incorrect Response

- Draws a direct path that goes over the next smaller hill with or without arrow(s) (see diagram below).
- Draws a path that circles around hill(s) by following contour lines with or without arrow(s) (see diagram below).
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Japan	47
Slovenia	46
Chinese Taipei-CHN	40
Finland	38
Korea, Rep. of	37
Russian Federation	35
Hong Kong-CHN	30
Australia	30
Singapore	30
Sweden	29
Iran, Islamic Rep. of	25
Norway	25
Hungary	24
Lithuania	24
Ukraine	24
Kazakhstan	23
England-GBR	21
Italy	21
United States	21
New Zealand	20
International average	19
Malaysia	18
Romania	17
Israel	14
Jordan	13
Macedonia, Rep. of	13
Tunisia	12
Chile	12
Bahrain	11
Qatar	10
United Arab Emirates	9
Turkey	9
Morocco	9
Georgia	8
Palestinian Nat'l Auth.	8
Oman	7
Armenia	7
Syrian Arab Republic	7
Lebanon	6
Indonesia	5
Thailand	2
Ghana	1
Saudi Arabia	1

Benchmarking education system

Benchmarking education system	Percent
Massachusetts-USA	37
Alberta-CAN	35
Ontario-CAN	26
Minnesota-USA	25
Quebec-CAN	25
Colorado-USA	23
North Carolina-USA	21
Connecticut-USA	20
California-USA	20
Indiana-USA	17
Florida-USA	14
Alabama-USA	13
Dubai-UAE	11
Abu Dhabi-UAE	10

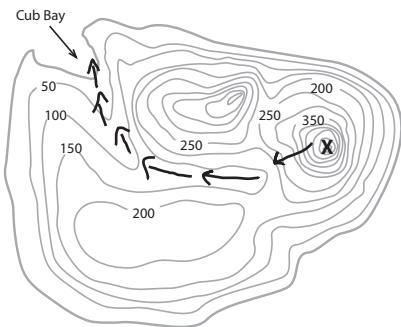
Percent higher than International average
 Percent lower than International average

Topographic map: river path (continued)

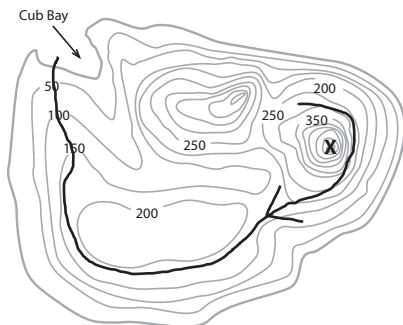
S032651B:

Student Responses

Correct Response:

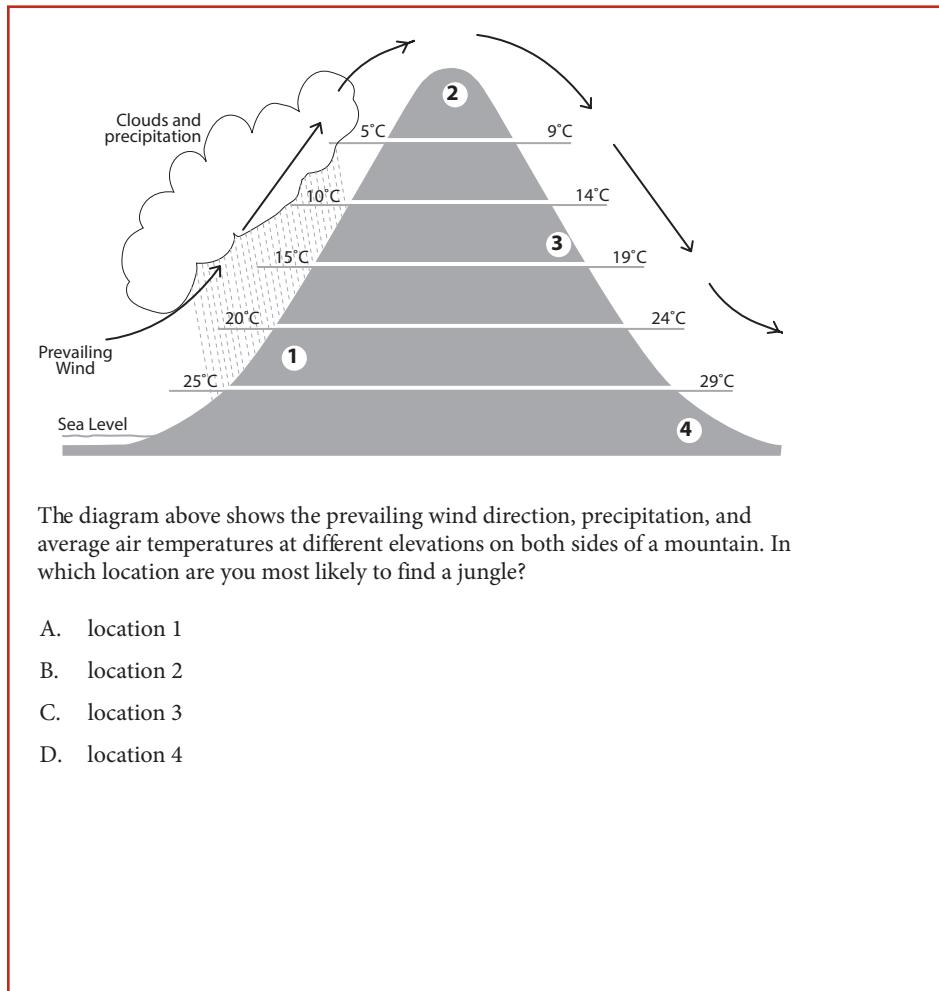


Incorrect Response:



Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Processes, Cycles, and History	Reasoning

Location of jungle



- A. location 1
- B. location 2
- C. location 3
- D. location 4

Item Number: S032654

Correct Response:	A
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Overall Percent Correct

Education system	Percent correct
Slovenia	71
Finland	70
Russian Federation	65
Hungary	65
Chinese Taipei-CHN	64
Hong Kong-CHN	64
Lithuania	62
Iran, Islamic Rep. of	59
Sweden	58
Ukraine	57
Singapore	56
United States	56
Japan	56
Korea, Rep. of	55
Turkey	55
Australia	53
Norway	53
United Arab Emirates	51
New Zealand	50
Italy	49
Israel	49
England-GBR	48
International average	47
Macedonia, Rep. of	46
Oman	45
Qatar	45
Chile	44
Tunisia	43
Saudi Arabia	43
Jordan	41
Malaysia	38
Thailand	37
Romania	36
Bahrain	34
Palestinian Nat'l Auth.	33
Armenia	33
Georgia	30
Indonesia	29
Lebanon	27
Morocco	25
Syrian Arab Republic	25
Kazakhstan	24
Ghana	22

Benchmarking education system

Massachusetts-USA	66
Minnesota-USA	64
Colorado-USA	63
Florida-USA	57
Alberta-CAN	56
Connecticut-USA	55
Indiana-USA	54
Ontario-CAN	54
North Carolina-USA	53
Dubai-UAE	51
Abu Dhabi-UAE	51
California-USA	51
Quebec-CAN	48
Alabama-USA	46

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Processes, Cycles, and History	Knowing

Where active volcanoes are found

Where are active volcanoes most likely to be found?

- A. where rivers form
- B. where tectonic plates meet
- C. where oceans are deepest
- D. where land and water meet

Item Number: S042141

Correct Response:

B

Overall Percent Correct

Education system	Percent correct
Finland	93
Hong Kong-CHN	89
Lithuania	87
Russian Federation	85
Slovenia	85
England-GBR	84
Chinese Taipei-CHN	81
Sweden	80
Ukraine	80
Australia	79
Italy	78
Korea, Rep. of	78
United States	77
Romania	74
New Zealand	74
Kazakhstan	73
Singapore	73
Norway	72
Israel	72
Chile	71
Armenia	70
Bahrain	70
Japan	69
Morocco	69
United Arab Emirates	67
Hungary	67
International average	65
Thailand	64
Oman	61
Macedonia, Rep. of	60
Iran, Islamic Rep. of	58
Tunisia	53
Qatar	51
Saudi Arabia	50
Palestinian Nat'l Auth.	47
Indonesia	46
Syrian Arab Republic	44
Georgia	44
Jordan	43
Turkey	42
Malaysia	36
Lebanon	32
Ghana	21

Benchmarking education system

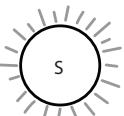
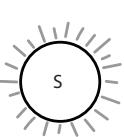
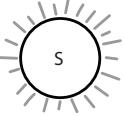
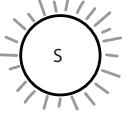
Quebec-CAN	88
Minnesota-USA	87
Massachusetts-USA	86
North Carolina-USA	85
Colorado-USA	84
Indiana-USA	84
Alberta-CAN	82
Connecticut-USA	79
Florida-USA	75
Ontario-CAN	69
Alabama-USA	68
California-USA	67
Dubai-UAE	67
Abu Dhabi-UAE	66

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth in the Solar System and the Universe	Applying

Diagram of an eclipse of the moon

Which diagram shows the position of the Sun (S), moon (M), and Earth (E) during an eclipse of the moon? (Not drawn to scale)

- A.  M E
- B.  O M E
- C.  E M O
- D.  E M O

Item Number: S042215

Correct Response:	D
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Overall Percent Correct

Education system	Percent correct
Iran, Islamic Rep. of	53
Palestinian Nat'l Auth.	50
Finland	49
Armenia	46
Korea, Rep. of	44
Norway	44
Ukraine	43
Saudi Arabia	43
Hungary	42
Slovenia	42
Bahrain	40
Macedonia, Rep. of	40
Japan	39
Chinese Taipei-CHN	38
Hong Kong-CHN	38
Oman	38
Malaysia	37
International average	35
Lithuania	34
Sweden	34
Israel	34
Kazakhstan	33
Syrian Arab Republic	33
Indonesia	32
Italy	32
Russian Federation	32
Thailand	31
Georgia	31
Morocco	31
Qatar	31
United Arab Emirates	30
Lebanon	30
Turkey	30
Singapore	30
Jordan	29
Romania	29
United States	28
Tunisia	26
England-GBR	26
New Zealand	25
Australia	23
Chile	19
Ghana	17

Benchmarking education system

Connecticut-USA	40
Quebec-CAN	40
Massachusetts-USA	37
Florida-USA	35
Minnesota-USA	32
Colorado-USA	30
California-USA	30
Abu Dhabi-UAE	30
North Carolina-USA	29
Dubai-UAE	28
Alberta-CAN	27
Indiana-USA	27
Alabama-USA	25
Ontario-CAN	22

Percent higher than International average
 Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Processes, Cycles, and History	Applying

Evaporated water ending up as rain

How does water that has evaporated from the sea end up as rain on land many miles away?

Item Number: S042317

SCORING

Correct Response

- Mentions two OR three of the factors indicated below.
- Clouds form (condensation)
 - The clouds move to land (blown by the wind)
 - Rain falls from clouds (because drops become too heavy/temperature drops).
- Example: That's because there will be condensation and the clouds form. The clouds move to land and when temperatures drop the water in the clouds condenses and fall as rain.

Partially Correct Response

- Mentions only one factor indicated above.

Example: Water vapor condenses into clouds. (a)

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	70
Finland	66
Japan	65
Hong Kong-CHN	63
Iran, Islamic Rep. of	62
Russian Federation	61
Australia	61
Korea, Rep. of	59
Norway	57
England-GBR	57
Israel	56
United States	56
Chinese Taipei-CHN	55
Sweden	55
Lithuania	51
Hungary	48
New Zealand	48
Oman	47
Slovenia	47
Italy	47
United Arab Emirates	45
Jordan	45
Turkey	44
Chile	44
Ukraine	42
International average	42
Bahrain	39
Qatar	34
Kazakhstan	32
Thailand	31
Syrian Arab Republic	29
Tunisia	27
Saudi Arabia	24
Palestinian Nat'l Auth.	23
Romania	23
Georgia	22
Indonesia	21
Morocco	20
Macedonia, Rep. of	19
Lebanon	18
Armenia	16
Malaysia	16
Ghana	9

Benchmarking education system

Massachusetts-USA	69
Minnesota-USA	68
Colorado-USA	67
Indiana-USA	58
Alberta-CAN	57
North Carolina-USA	56
Ontario-CAN	56
Florida-USA	54
Connecticut-USA	54
California-USA	50
Quebec-CAN	48
Abu Dhabi-UAE	47
Dubai-UAE	47
Alabama-USA	41

Percent higher than International average
 Percent lower than International average

Evaporated water ending up as rain (continued)

S042317:

Student Responses

Correct Response:

The water vapor condenses in the air, forming clouds. Once the process of condensation ceases, it falls onto land as precipitation.



Incorrect Response:

because clouds can travel far

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Processes, Cycles, and History	Reasoning

Evidence continents were joined

Two continents are separated by water.

Geologists are looking for evidence that the two continents were once joined.

What fossil evidence would support this idea?

Item Number: S052032

SCORING

Correct Response

- Explains that fossils from identical (land) organisms (that cannot fly or swim) can be found on both continents.

Examples:

The same species of extinct animals are found on the two continents.

If the same fossilized animals are found on both continents.

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Iran, Islamic Rep. of	48
Japan	43
Italy	38
United States	37
Israel	34
Chinese Taipei-CHN	32
Russian Federation	31
Slovenia	29
Korea, Rep. of	28
England-GBR	28
New Zealand	27
Australia	27
Sweden	24
Lithuania	23
Singapore	22
Romania	21
Kazakhstan	20
Ukraine	20
Norway	20
Hong Kong-CHN	19
International average	18
Finland	18
Jordan	17
Chile	15
United Arab Emirates	15
Syrian Arab Republic	13
Hungary	12
Oman	10
Macedonia, Rep. of	9
Turkey	8
Armenia	8
Georgia	8
Thailand	8
Palestinian Nat'l Auth.	7
Qatar	6
Indonesia	5
Morocco	5
Malaysia	5
Bahrain	5
Lebanon	3
Saudi Arabia	3
Tunisia	2
Ghana	—

Benchmarking education system

Massachusetts-USA	58
Minnesota-USA	53
North Carolina-USA	46
Alberta-CAN	46
Colorado-USA	44
Indiana-USA	41
Connecticut-USA	38
Florida-USA	35
California-USA	32
Ontario-CAN	29
Quebec-CAN	21
Alabama-USA	19
Dubai-UAE	16
Abu Dhabi-UAE	15

Percent higher than International average

Percent lower than International average

— Not applicable

Evidence continents were joined (continued)

S052032:

Student Responses

Correct Response:

the same fossils being found on
different continents.

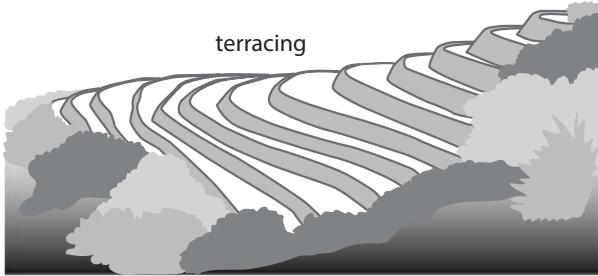
Incorrect Response:

dirt

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Resources, Their Use and Conservation	Applying

Advantage of terracing method

The diagram below shows a field on a slope that is being farmed using the terracing method.



Write one advantage of using the method of farming shown in the diagram.

Item Number: S052106

SCORING

Correct Response

- Writes one advantage of using the terracing method from the list of acceptable responses below.
- Allows farming to be done on a slope (utilize more land)
Run-off slowed down (prevents crops from washing away)
Prevents soil erosion (landslides, rock slides)
Able to grow different crops
Retains water so crops are healthier/need less watering
Examples:
You can farm in steep places.
Helps to avoid the washing away of crops on hills.

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	56
Chinese Taipei-CHN	52
Slovenia	51
Japan	49
Korea, Rep. of	41
Turkey	40
Italy	38
Hong Kong-CHN	37
Malaysia	34
Hungary	33
Russian Federation	32
United States	32
Indonesia	31
England-GBR	30
Romania	30
Thailand	30
Israel	27
Palestinian Nat'l Auth.	27
Australia	27
International average	26
Syrian Arab Republic	24
Kazakhstan	22
Jordan	22
Norway	22
Tunisia	22
Finland	21
Lithuania	20
United Arab Emirates	20
New Zealand	17
Iran, Islamic Rep. of	17
Ukraine	17
Armenia	16
Oman	16
Morocco	14
Saudi Arabia	14
Bahrain	14
Lebanon	13
Qatar	13
Georgia	13
Macedonia, Rep. of	11
Sweden	11
Chile	10
Ghana	8

Benchmarking education system

Massachusetts-USA	42
Minnesota-USA	40
Connecticut-USA	34
Colorado-USA	34
Florida-USA	33
Indiana-USA	32
North Carolina-USA	32
Alberta-CAN	31
California-USA	30
Dubai-UAE	28
Quebec-CAN	24
Alabama-USA	23
Ontario-CAN	23
Abu Dhabi-UAE	17

Percent higher than International average
 Percent lower than International average

Advantage of terracing method (continued)

S052106:

Student Responses

Correct Response:

You get a selection of plants and rain
So you can grow different plants on
each row.

Incorrect Response:

You can walk up instead of straight?

Content Domain	Main Topic	Cognitive Domain
EARTH SCIENCE	Earth's Processes, Cycles, and History	Knowing

Holes in volcanic rocks

Some volcanic rocks have many holes in them.



How were the holes made?

- A. Insects dug into the rock when it was soft.
- B. Gas bubbles were trapped in the rock when it cooled.
- C. Rain dropped on the rock when it was soft.
- D. Small stones fell out of the rock when it cooled.

Item Number: S052297

Correct Response:

B

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	90 ▲
Australia	84 ▲
New Zealand	84 ▲
United States	81 ▲
England-GBR	80 ▲
Japan	77 ▲
Singapore	76 ▲
Russian Federation	75 ▲
Norway	75 ▲
Slovenia	72 ▲
Hungary	71 ▲
Italy	68 ▲
Finland	68 ▲
Hong Kong-CHN	64 ▲
Sweden	64 ▲
Thailand	64 ▲
Ukraine	61
Georgia	60
Romania	60
International average	57
Israel	57
Kazakhstan	57
Lithuania	54
United Arab Emirates	52 ▼
Chinese Taipei-CHN	50 ▼
Chile	49 ▼
Qatar	48 ▼
Armenia	47 ▼
Lebanon	46 ▼
Turkey	46 ▼
Bahrain	46 ▼
Morocco	46 ▼
Oman	45 ▼
Syrian Arab Republic	45 ▼
Iran, Islamic Rep. of	45 ▼
Malaysia	42 ▼
Tunisia	40 ▼
Indonesia	40 ▼
Jordan	39 ▼
Saudi Arabia	39 ▼
Palestinian Nat'l Auth.	38 ▼
Macedonia, Rep. of	35 ▼
Ghana	25 ▼

Benchmarking education system

Minnesota-USA	91 ▲
Colorado-USA	89 ▲
Alberta-CAN	88 ▲
Massachusetts-USA	88 ▲
Ontario-CAN	85 ▲
Quebec-CAN	84 ▲
Indiana-USA	83 ▲
Connecticut-USA	79 ▲
California-USA	79 ▲
Florida-USA	78 ▲
North Carolina-USA	78 ▲
Alabama-USA	74 ▲
Dubai-UAE	58
Abu Dhabi-UAE	49 ▼

▲ Percent higher than International average
▼ Percent lower than International average