TIMSS

IEA's Third International Mathematics and Science Study

TIMSS Science Items:

Released Set for Population 1 (Third and Fourth Grades)

Overview of TIMSS

TIMSS is a collaborative research project sponsored by the International Association for the Evaluation of Educational Achievement (IEA). In 1994-95, achievement tests in mathematics and science were administered to carefully selected samples of students in classrooms around the world. With more than 40 countries participating, five grades assessed in two school subjects, more than half a million students tested in more than 30 languages, and millions of open-ended responses generated, TIMSS is the largest and most ambitious study of comparative educational achievement ever undertaken.

TIMSS tested and collected contextual information about the schooling of students in the following grade levels:

- Students enrolled in the two adjacent grades that contained the largest proportion of 9-year-olds students – grades 3 and 4 in many countries
- Students enrolled in the two adjacent grades that contained the largest proportion of 13-year-old students – grades 7 and 8 in many countries
- Students in their final year of secondary education. As an additional option, countries could test two special subgroups of these students:
  - Students taking advanced courses in mathematics
  - Students taking advanced courses in physics

The three different groups of TIMSS students listed above are often referred to as Populations 1, 2, and 3, respectively. All countries participated in the testing at Population 2 (grades 7 and 8), which is the core of TIMSS. Countries could choose whether or not to participate in the testing at the other two populations. Table 1 lists the 26 participants that satisfied all of the steps necessary to have their Population 1 science achievement results published in the international report.[1] Forty-one countries had achievement results published for Population 2 [2] and about 25 countries participated in the testing at Population 3.

[1] Martin, M.O., Mullis, I.V.S., Beaton, A.E., Gonzalez, E.J., Smith, T.A., and Kelly, D.L. (1997). *Science Achievement in the Primary School Years: IEA's Third International Mathematics and Science Study (TIMSS)*. Chestnut Hill, MA: Boston College.

[2] Beaton, A.E., Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Smith, T.A., and Kelly, D.L. (1996). *Science Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study (TIMSS)*. Chestnut Hill, MA: Boston College.

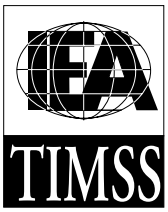
Table 1

TIMSS Participants

Included in the TIMSS International Analyses at Population 1

- Australia
- Austria
- Canada
- Cyprus
- Czech Republic
- England
- Greece
- Hong Kong
- Hungary
- Iceland
- Iran, Islamic Republic
- Ireland
- Israel*
- Japan
- Korea, Republic of
- Kuwait*
- Latvia
- Netherlands
- New Zealand
- Norway
- Portugal
- Scotland
- Singapore
- Slovenia
- Thailand
- United States

* Participated only at the upper grade.



The success of TIMSS depended on a collaborative effort between the research centers in each country responsible for implementing the project, and the network of centers responsible for managing across-country tasks such as training country representatives in standardized procedures, selecting comparable samples of schools and students, and conducting the various steps required for data processing and analysis. The TIMSS International Study Center, responsible for the international coordination of tasks, is housed in the Center for the Study of Testing, Evaluation, and Educational Policy (CSTEEP) at Boston College.

The TIMSS Science Test

The TIMSS curriculum framework underlying the science tests at all three populations was developed by groups of science educators with input from the TIMSS National Research Coordinators (NRCs).[3] The **content** aspect of the framework represents the subject matter content of school science. The **performance expectations** aspect of the framework describes, in a non-hierarchical way, the many kinds of performances or behaviors that might be expected of students in school science. Working within the science curriculum framework, science test specifications were developed for Population 1 that included items representing a wide range of science topics and eliciting a range of skills from the students.

The tests were developed through an international consensus involving input from experts in science and measurement specialists.[4] The TIMSS Subject Matter Advisory Committee, which included distinguished scholars from 10 countries, ensured that the test reflected current thinking and priorities within the field of science. The items underwent an iterative development and review process, with several pilot efforts. Every effort was made to help ensure that the tests represented the curricula of the participating countries and that the items did not exhibit any bias towards or against particular countries, including modifying specifications in accordance with data from the curriculum analysis component, obtaining ratings of the items by subject matter specialists within the participating countries, and conducting thorough statistical item analysis of data collected in the pilot testing. The final forms of the test were endorsed by the NRCs of all the participating countries. The resulting test for the Population 1 students (third and fourth grades in many countries) contained 97 science items representing a range of science topics and skills.

Approximately one-fourth of the TIMSS items were in the free-response format, which required students to generate and write their own answers. Designed to represent approximately one-third of students' response time, some free-response questions asked for short answers, while others called for extended responses and required students to show their work. The remaining questions used a multiple-choice format. The distribution of items across content areas (as reported in the international reports) and performance expectations, as well as by item format, is presented in Table 2.

[3] The complete TIMSS curriculum frameworks can be found in Robitaille, D.F. et al. (1993). *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science*. Vancouver, B.C.: Pacific Educational Press.

[4] Please see Garden, R.A. (1996), "Development of the TIMSS Achievement Items" in D.F. Robitaille and R.A. Garden (Eds.), *TIMSS Monograph No. 2: Research Questions and Study Design*. Vancouver, B.C. Pacific Education Press; and Garden, R.A. and Orpwood, G. (1996). "Development of the TIMSS Achievement Test" in M.O. Martin and D.L. Kelly (Eds.), *Third International Mathematics and Science Study Technical Report, Volume I: Design and Development*. Chestnut Hill, MA: Boston College.

Table 2

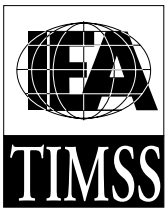
Distribution of Science Items by Content Reporting Category and Performance Expectation[1] - Population 1

Content Category	Number of Items	Number of Multiple-Choice Items	Number of Short-Answer Items	Number of Extended-Response Items
Earth Science	17 (5)	13 (2)	2 (1)	2 (2)
Life Science	41 (28)	33 (20)	5 (5)	3 (3)
Physical Science	30 (22)	23 (15)	4 (4)	3 (3)
Environmental Issues and the Nature of Science	9 (6)	5 (3)	2 (1)	2 (2)
Total	97 (61)	74 (40)	13 (11)	10 (10)

Performance Expectation	Number of Items	Number of Multiple-Choice Items	Number of Short-Answer Items	Number of Extended-Response Items
Understanding Simple Information	44 (19)	42 (17)	1 (1)	1 (1)
Understanding Complex Information	30 (22)	21 (15)	5 (4)	4 (3)
Theorizing, Analyzing, and Solving Problems	14 (13)	3 (2)	6 (6)	5 (5)
Using Tools, Routine Procedures, and Science Processes	6 (6)	5 (5)	1 (1)	0 (0)
Investigating the Natural World	3 (1)	3 (1)	0 (0)	0 (0)

[1] Figure in parentheses refers to the number of items in the released item set and provided in this volume.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.



To ensure broad subject matter coverage without overburdening individual students, TIMSS used a rotated design that included both the mathematics and science items. In accordance with the design, the mathematics and science items were assembled in 26 different clusters — labeled A through Z. The clusters were assigned to eight different booklets in accordance with the rotated design so that representative samples of students responded to each cluster.[5] Each Population 1 student completed one test booklet containing both mathematics and science items. Population 1 students were given about an hour of testing time (37 minutes before a short break and 27 minutes after the break).

Item Release Policy

In accordance with IEA policy, TIMSS has kept about one-third of the TIMSS items secure for possible future use in measuring international trends in mathematics and science achievement. For Population 1, the secure items are in clusters labeled A through H. All remaining items (in clusters I through Z) are available for general use. To facilitate this use, the released TIMSS items for Population 1 (third and fourth grades) have been replicated in their entirety in this science volume and in the companion mathematics volume. As shown in Table 2, this volume contains 61 science items, including most of the free-response questions. To provide a unique identifier for each item, the TIMSS cluster and item number is shown in the black box on the right hand side of each page.

While the purpose of this volume is to encourage the use of TIMSS items, please note the IEA copyright. Appropriate references to the IEA and TIMSS should be provided in your use of these items.

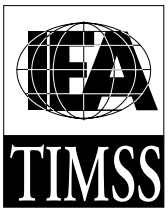
Item Documentation and Item Results

The TIMSS tests were prepared in English and translated into the local languages. Each item is reproduced for this volume exactly as it was presented to each of the TIMSS countries. In translating the tests or making adaptations for cultural purposes, every effort was made to ensure that the meaning and difficulty of items did not change. This process required an enormous effort by the national centers, with many checks made along the way.[6]

Across the bottom of each item, there is documentation about the item, including the subject assessed and the classification of the item by content category and performance expectation. If the item is a two-part item, the documentation for Part A is shown on the first page and the documentation for Part B is shown on the following page.

[5] The TIMSS test design is fully documented in Adams, R. and Gonzalez, E. (1996). "Design of the TIMSS Achievement Instruments" in D.F. Robitaille and R.A. Garden (Eds.), *TIMSS Monograph No. 2: Research Questions and Study Design*. Vancouver, B.C.: Pacific Education Press; and Adams, R. and Gonzalez, E. (1996). "TIMSS Test Design" in M.O. Martin and D.L. Kelly (Eds.), *Third International Mathematics and Science Study Technical Report, Volume I: Design and Development*. Chestnut Hill, MA: Boston College.

[6] More details about the translation verification procedures can be found in Mullis, I.V.S., Kelly, D.L., and Haley, K. (1996). "Translation Verification Procedures" in M.O. Martin and I.V.S. Mullis (Eds.), *Third International Mathematics and Science Study: Quality Assurance in Data Collection*. Chestnut Hill, MA: Boston College; and Maxwell, B. (1996). "Translation and Cultural Adaptation of the TIMSS Instruments" in M.O. Martin and D.L. Kelly (Eds.), *Third International Mathematics and Science Study Technical Report, Volume I*. Chestnut Hill, MA: Boston College.



Subject. All of the items in this volume are science items. The mathematics items are provided in a companion volume, *TIMSS Mathematics Items: Released Set for Population 1 (Third and Fourth Grades).*

Key. For multiple-choice items, the key for the correct answer is provided. For free-response questions, the categories of responses and their codes are shown on the page following the item. In scoring the TIMSS free-response questions, TIMSS utilized two-digit codes with rubrics specific to each item. The first digit designates the correctness level of the response. The first digit is usually a "1" designating a correct response, a "7" indicating an incorrect response, or a "9" for non-response. Sometimes, however, fully correct responses are differentiated from partially correct responses. In these instances, the fully correct responses are designated by a "2" and the partially correct responses by a "1." The second digit, combined with the first digit, represents a diagnostic code used to identify specific types of approaches, strategies, or common errors and misconceptions.

Content Category. The science items were reported according to four content areas.

- Earth Science
- Life Science
- Physical Science
- Environmental Issues and the Nature of Science

Table 3 indicates which items have been classified into each of the four content areas.

Performance Expectation. Items were classified into the following performance expectations.

- Understanding Simple Information
- Understanding Complex Information
- Theorizing, Analyzing, and Solving Problems
- Using Tools, Routine Procedures, and Science Processes
- Investigating the Natural World

Percent of Students Responding Correctly. The percent of students responding correctly to the item reflects the international average across the countries participating in TIMSS at each grade tested. That is, first the percentage of students responding correctly to the item was calculated for each country. Next, an average was calculated across countries. For the upper grade (fourth grade in many countries), this average was calculated across 26 countries (see Table 1). For the lower grade (third grade in many countries), the average is based on 24 countries. For items using a partial credit scoring scheme, the percentages given are for students responding with fully correct answers.

International Difficulty Index. This statistic reflects the difficulty of the item as estimated from item response theory scaling (IRT). Since the TIMSS scale was developed based on the performance of students at both grades in all countries, the international scale values apply to both grades and to all countries. The higher the index, the more difficult the item.

Table 3

Item Listing by Science Content Area

Earth Science	N01	Temperature/precipitation table.
	O04	Moon shining at night.
	O09	Snow on mountain.
	Y01	Size of sun and moon.
	Z01A	River on the plain: good place for farming.
	Z01B	River on the plain: bad place for farming.
Life Science	N02	Which are living things?
	N03	Body temperature.
	N05	Where does bird live?
	N06	Where does baby chick get food?
	O02	Why did seeds not sprout?
	O03	Stages of plant growth.
	O07	Which animal produces milk?
	P01	Adult stage of caterpillar.
	P02	Plants found in very dry places.
	P08	Birds different from insects.
	P09	Seeds in plants.
	Q01	Changes in butterfly eggs.
	Q02	Why eat fruits and vegetables?
	Q05	Animal breathes faster.
	Q06	Which is not an insect?
	R03	Insect carries pollen.
	R04	Why use sunscreen?
	R06	Which animal has backbone?
	R07	Worm in box?
	W02	Function of the heart.
	W03	Thirst on a hot day.
	W04	Human skull.
	X02	Animals and plants.
	X04	Stages in frog's growth.
	X05	In which group do fish belong?
	Y02A	Changes in children's bodies: one change.
	Y02B	Changes in children's bodies: two changes.
	Y03A	Ways animals protect themselves: one way.
	Y03B	Ways animals protect themselves: two ways.
	Z02	Structural features of animals.
Physical Science	N04	Block floating in water.
	N07	Girl's source of energy.
	N08	Powder with white/black specks.
	N09	Which box has least mass?
	O01	Balance on seesaw.
	O05	What would reflection look like?
	O08	Mixture of iron and sand.
	P03	What is not energy source?
	P04	Beaker on scale.
	P05	Magnet and coffee.
	P07	What travels fastest?
	Q03	Which doesn't change in wet ground?
	Q04	Glass over candle.
	Q08	Pencil in the mirror.
	Q09	Why does liquid in thermometer rise?
	R01	Tipped watering can.
	R05	Sound through string.
	R08	Which produces light?
	R09	Advantage of solar energy.
	W01	Dissolve sugar.
	X01	Two bowls of soup.
	Z03	Weights of three blocks.
Environmental Issues and the Nature of Science	O06	How computers help?
	P06	Growing seeds in light or dark.
	Q07	Observations of objects in bag.
	R02	Which bulb is brightest?
	W05A	Reducing air pollution: one way.
	W05B	Reducing air pollution: two ways.
	X03	Oil spills.

For More Information About TIMSS

For more details about the TIMSS results and procedures, please see the following reports:

Mathematics Achievement in the Primary School Years: IEA's Third International Mathematics and Science Study. Mullis, I.V.S., Martin, M.O., Beaton, A.E., Gonzalez, E.J., Kelly, D.L., and Smith, T.A. Chestnut Hill, MA: Boston College, 1997.

Science Achievement in the Primary School Years: IEA's Third International Mathematics and Science Study. Martin, M.O., Mullis, I.V.S., Beaton, A.E., Gonzalez, E.J., Smith, T.A., and Kelly, D.L. Chestnut Hill, MA: Boston College, 1997.

Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study. Beaton, A.E., Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Kelly, D.L., and Smith, T.A. Chestnut Hill, MA: Boston College, 1996.

Science Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study. Beaton, A.E., Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Smith, T.A., and Kelly, D.L. Chestnut Hill, MA: Boston College, 1996.

Third International Mathematics and Science Study Technical Report, Volume I: Design and Development. Martin, M.O. and Kelly, D.L., Eds. Chestnut Hill, MA: Boston College, 1996.

Third International Mathematics and Science Study: Quality Assurance in Data Collection. Martin, M.O. and Mullis, I.V.S., Eds. Chestnut Hill, MA: Boston College, 1996.

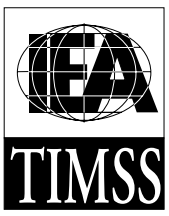
These reports can be ordered from the International Study Center at Boston College.

- To FAX Order: +1(617)552-8419
- To Phone Order: +1(617)552-4521
- To E-mail Order: timss@bc.edu

TIMSS reports and this released item set are also available on the World Wide Web:

- http://wwwcsteep.bc.edu/timss

Released Science Items
Population 1



N1. This table shows the temperature and precipitation (rain or snow) in four different towns on the same day.

	Town A	Town B	Town C	Town D
Lowest Temperature	13˚C	-9˚C	22˚C	-12˚C
Highest Temperature	25˚C	-1˚C	30˚C	-4˚C
Precipitation (rain or snow)	0 cm	5 cm	2.5 cm	0 cm

Where did it snow?

A. Town A

B. Town B

C. Town C

D. Town D

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	B	Earth Science	Using Tools, Routine Procedures, and Science Process	44%	32%	632

N2. Which one of these refers only to living things?

A. clouds, fire, rivers

B. fire, rivers, trees

C. rivers, birds, trees

D. birds, trees, worms

E. trees, worms, clouds

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	D	Life Science	Understanding Complex Information	74%	63%	475

N3. Your temperature is taken when you are NOT sick. Which temperature is CLOSEST to what the thermometer would show?

A. 29˚C

B. 37˚C

C. 100˚C

D. 212˚C

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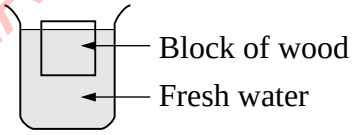
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	B	Life Science	Understanding Simple Information	48%	37%	620

N4. The picture shows a block of wood floating in fresh water.

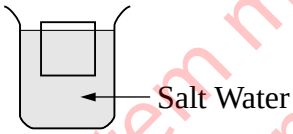


If this block were placed in salt water from the ocean, which picture shows what would happen?

A.

B.

C.



D.

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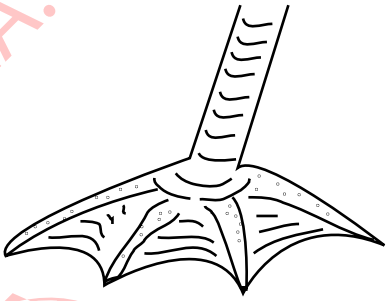
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	D	Physical Science	Understanding Complex Information	34%	30%	665

N5. This is a drawing of a bird's foot.



Where would you be MOST likely to find such a bird?

A. a forest

B. a meadow

C. a cornfield

D. a desert

E. a lake

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	E	Life Science	Understanding Simple Information	71%	61%	468

N6. A baby chick grows inside an egg for 21 days before it hatches. Where does the baby chick get its food before it hatches?

A. It is fed by the mother hen.

B. It doesn't need any food.

C. It makes its own food.

D. It uses food stored in the egg.

E. It eats the egg shell.

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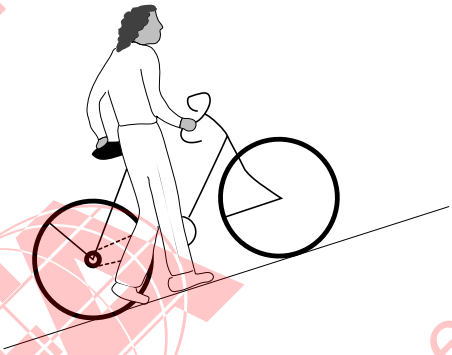
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	D	Life Science	Understanding Simple Information	43%	35%	625

N7. Keisha is pushing her bicycle up a hill. Where does Keisha get the energy to push her bicycle?



A. From the food she has eaten

B. From the exercise she did earlier

C. From the ground she is walking on

D. From the bicycle she is pushing

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	A	Physical Science	Understanding Simple Information	52%	45%	571

N8. A powder made up of both white specks and black specks is likely to be

A. a solution

B. a pure compound

C. a mixture

D. an element

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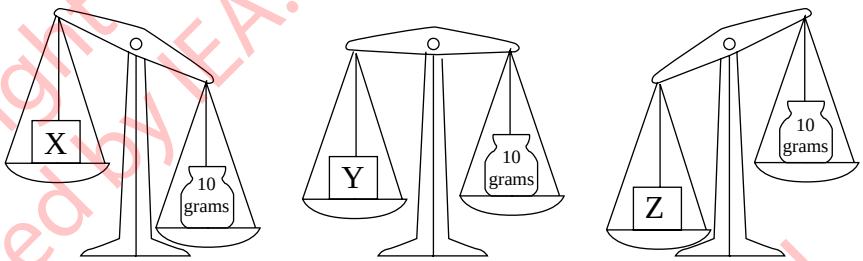
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	C	Physical Science	Understanding Complex Information	61%	52%	534

N9. Which of the boxes X, Y, or Z has the LEAST mass?



A. X

B. Y

C. Z

D. All three boxes have the same mass.

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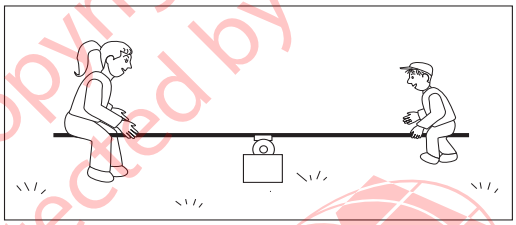
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	A	Physical Science	Usiong Tools, Routine Procedures, and Science Process	62%	52%	529

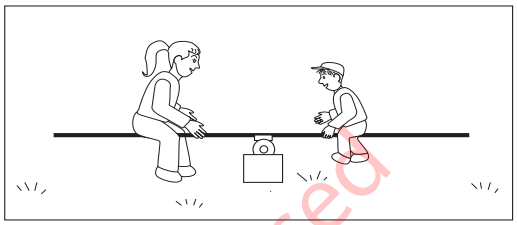
O1. A girl wanted to play on a seesaw with her little brother.

Which picture shows the best way for the girl, who weighed 50 kg (kilograms), to balance her brother, who weighed 25 kg?

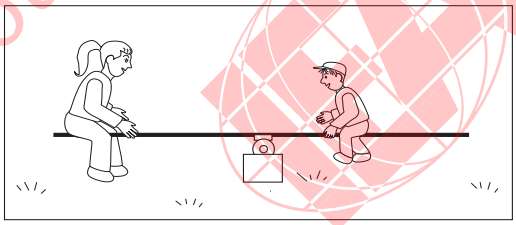
A.



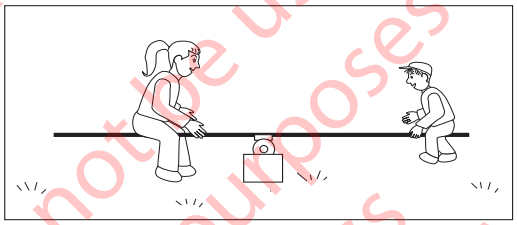
B.



C.



D.



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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	D	Physical Science	Theorizing, Analyzing, and Solving Problems	46%	38%	606

O-2

O2. John kept some seeds on moist cotton in a dish. Mike put the same kind of seeds in a dish beside John's dish, and covered them with water. After two days, John's seeds sprouted, but Mike's did not.

Which is the most likely reason?

A. Mike's seeds needed more air.

B. Mike's seeds needed more light.

C. Mike did not put the dish in a warm enough place.

D. Mike should have used a different kind of seed.

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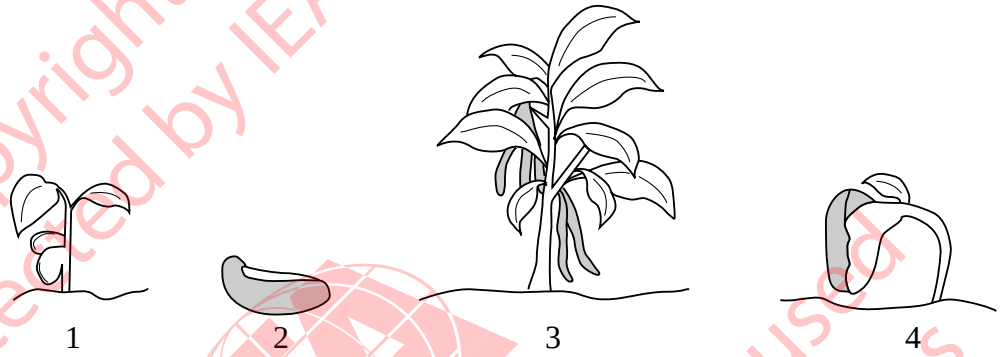
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	A	Life Science	Understanding Complex Information	41%	34%	630

O3. The pictures show a bean plant at different stages of growth. (The pictures are not drawn on the same scale.)



In what order do these stages take place?

A. 2, 1, 3, 4

B. 2, 4, 1, 3

C. 3, 2, 1, 4

D. 4, 2, 3, 1

E. 4, 3, 2, 1

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	B	Life Science	Understanding Simple Information	69%	60%	505

O-4

O4. The Moon produces no light, and yet it shines at night. Why is this?

A. The Moon reflects the light from the Sun.

B. The Moon rotates at a very high speed.

C. The Moon is covered with a thin layer of ice.

D. The Moon has many craters.

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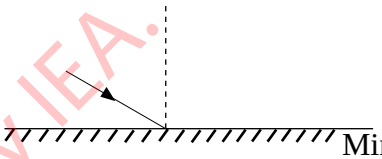
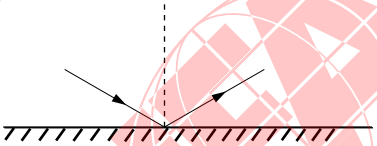
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	A	Earth Science	Understanding Simple Information	70%	64%	485

O5. A beam of light strikes a mirror as shown.

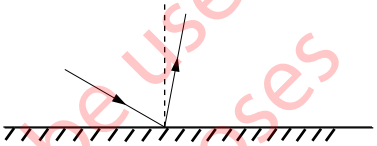


Which picture best shows what the reflected light would look like?

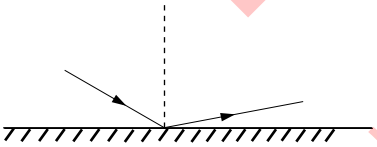
A.



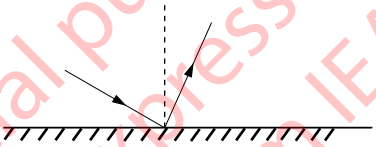
B.



C.



D.



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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	A	Physical Science	Theorizing, Analyzing, and Solving Problems	56%	49%	551

O6. Write down one example of how computers help people do their work.

O-6

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Environmental Issues and the Nature of Science	Understanding Complex Information	60%	47%	551

O-6 Coding Guide

O6. Write down one example of how computers help people do their work.

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Code	Response
Correct Response	
10	Refers to writing OR editing text. *Example: With a computer you can write faster and neater.*
11	Refers to doing calculations OR doing them faster.
12	Refers to computer storing or retrieving information (promptly). *Example: It helps keep files.*
13	Refers to using computers for instruction. *Examples: They teach you math.* *Computers help people understand things like math, science, or any subject at all.*
14	Refers to any combination of two or more of codes 10-13.
19	Other Correct: *Examples: The computer does no mistakes.* *It works faster.*
Incorrect Response	
70	Playing games such as Nintendo.
71	Vague references to "everything" or some similar expression.
76	Merely repeats information in stem.
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

O7. Which animal produces milk for its young?

A. Chicken

B. Frog

C. Monkey

D. Snake

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	C	Life Science	Understanding Simple Information	75%	67%	461

O-8

O8. In a box there is a mixture of iron filings and sand. Which is the easiest way to separate the iron filings from the sand?

A. Pour water on the mixture

B. Use a magnifying glass

C. Use a magnet

D. Heat the mixture

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	C	Physical Science	Understanding Complex Information	55%	46%	566

O9. Sometimes mountains can still have snow on their tops when the snow on the lower parts of the mountains has melted. What makes this happen?

O-9

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Earth Science	Theorizing, Analyzing, and Solving Problems	46%	31%	629

O-9 Coding Guide

O9. Sometimes mountains can still have snow on their tops when the snow on the lower parts of the mountains has melted. What makes this happen?

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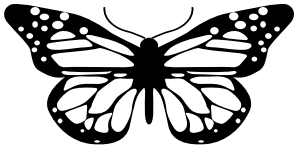
Code	Response
Correct Response	
10	Mentions that it is colder on the mountain tops or warmer farther down. *Example: The air is colder higher up*
11	Mentions that more snow is falling high up in the mountains.
19	Other correct.
Incorrect Response	
70	Mentions that there is sunshine lower down or there is more sunshine lower down.
71	Refers to sun or heat melting the snow. *Examples: The sun is warm.* *Sun shines and the snow melts.*
72	Refers to the mountain being very high.
73	Refers to the wind blowing more on the mountain top.
76	Merely repeats information in stem.
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

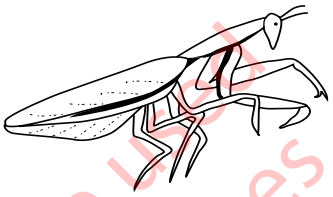
P-1

P1. When this caterpillar  becomes an adult, what will it look like?

A 

B 

C 

D 

E 

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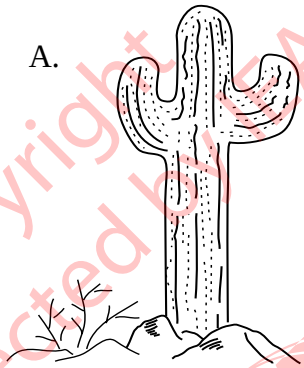
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	B	Life Science	Understanding Complex Information	85%	82%	382

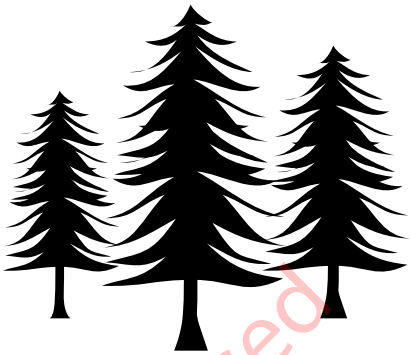
P-2

P2. Which picture shows plants commonly found in a desert?

A.



B.



C.

D.

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	A	Life Science	Understanding Complex Information	88%	82%	381

P-3

P3. Which is NOT used as an energy source?

A. Flowing water

B. Iron ore

C. Sun

D. Oil

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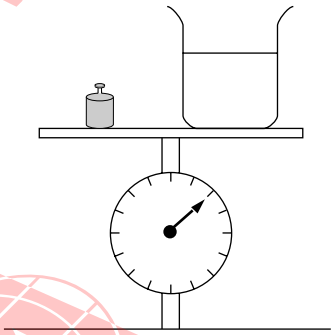
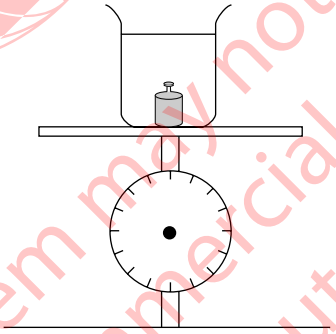
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	B	Physical Science	Understanding Simple Information	35%	29%	666

P4. Elizabeth put a weight and a beaker of water on a scale, as shown in the first picture.



Then she moved the beaker and put the weight in it, as shown in the second picture.



What will the scale show now? Draw an arrow on the second picture to show your answer.

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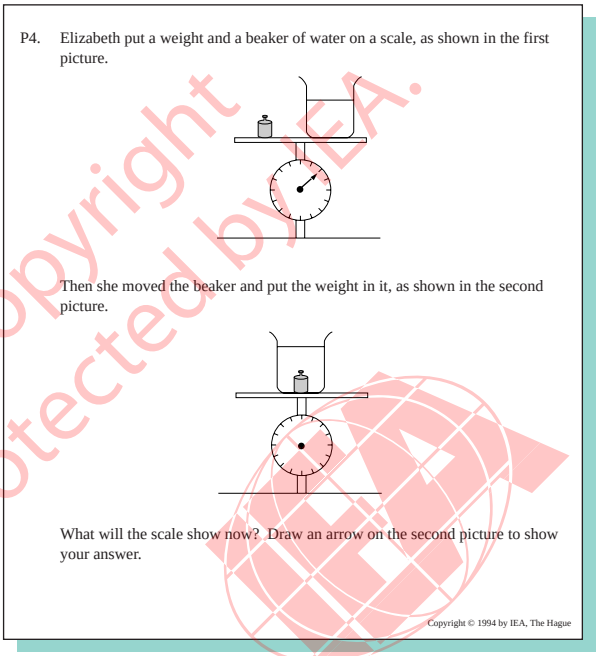
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Physical Science	Theorizing, Analyzing, and Solving Problems	34%	27%	672


P4. Elizabeth put a weight and a beaker of water on a scale, as shown in the first picture.

Then she moved the beaker and put the weight in it, as shown in the second picture.

What will the scale show now? Draw an arrow on the second picture to show your answer.

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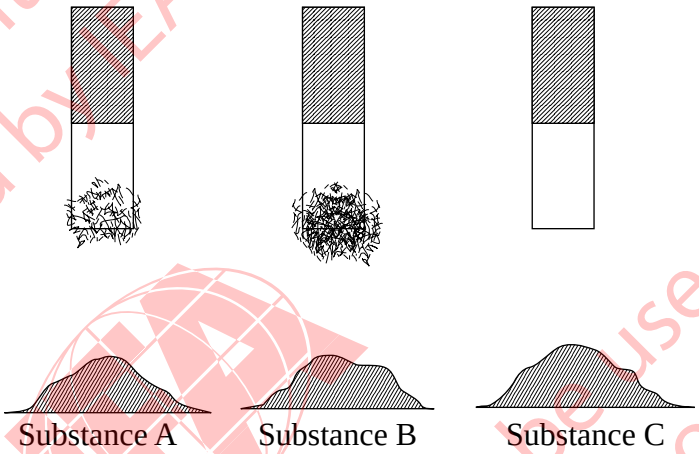
Code	Response
Correct Response	
10	The arrow or line is in the same position as in the first diagram or is described in words. Allow about 0.5 mm tolerance on each side.
Incorrect Response	
70	The arrow is pointing to a greater weight, that is the arrow is pointing downward somewhere between its original position and vertically down. OR the student states that it "Weighs more" or similar expression.
71	The arrow is pointing to a lesser weight than in the original picture, that is the arrow is pointing upward, between the original position and vertically up. OR the student states that it "Weighs less" or similar expression.
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

P5. Each of the three magnets shown has been dipped into the substance below it. Which of the substances could be coffee?



A. A only

B. B only

C. C only

D. A and B only

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	C	Physical Science	Understanding Complex Information	50%	41%	601

P6. To find out whether seeds grow better in the light or dark, you could put some seeds on pieces of damp paper and

A. keep them in a warm, dark place

B. keep one group in a light place and another in a dark place

C. keep them in a warm, light place

D. put them in a light or dark place that is cool

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	B	Environmental Issues and the Nature of Science	Investigating the Natural World	36%	29%	661

P7. Which travels fastest?

A. A train

B. An airplane

C. Sound

D. Light

P-7

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	D	Physical Science	Understanding Complex Information	41%	31%	632

P-8

P8. Birds are different from insects in that birds have

A. wings

B. legs

C. eyes

D. eggs

E. feathers

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	E	Life Science	Understanding Simple Information	60%	51%	562

P9. Seeds develop from which part of a plant?

A. Flower

B. Leaf

C. Root

D. Stem

P-9

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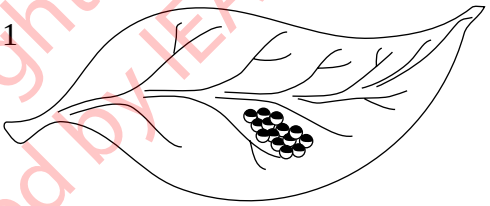
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	A	Life Science	Understanding Simple Information	46%	39%	619

Q-1

Q1. A butterfly sitting on a leaf laid some small eggs. The pictures show the changes that took place to the eggs.

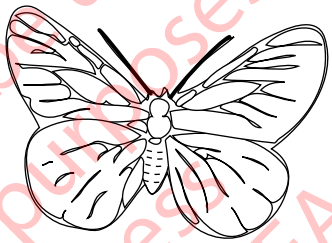
1



2

3

4



In what order did the changes take place?

A. 1, 2, 3, 4

B. 1, 3, 2, 4

C. 1, 4, 3, 2

D. 1, 4, 2, 3

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	B	Life Science	Understanding Simple Information	64%	56%	527

Q2. What is the BEST reason for including fruits and leafy vegetables in a healthy diet?

A. They have a high water content.

B. They are the best source of protein.

C. They are rich in minerals and vitamins.

D. They are the best source of carbohydrates.

Q-2

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	C	Life Science	Understanding Simple Information	65%	58%	513

Q-3

Q3. Some things were buried in wet ground. Several years later they were dug up. Which thing is MOST likely to have stayed the same?

A. An egg shell

B. A plastic cup

C. A paper plate

D. An orange peel

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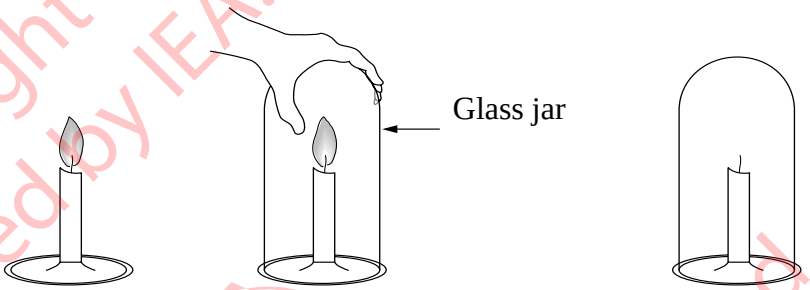
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	B	Physical Science	Understanding Complex Information	54%	46%	582

Q4. When a glass jar is placed over a lighted candle, the flame goes out.



Why does this happen?

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Q-4

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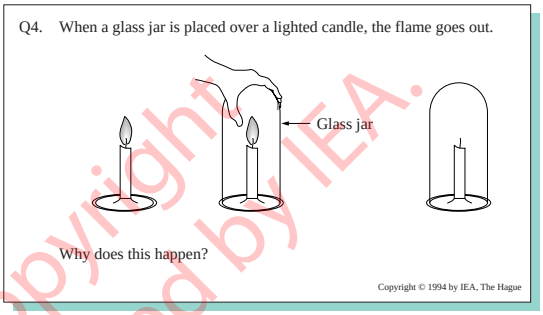
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Physical Science	Theorizing, Analyzing, and Solving Problems	64%	49%	540

Q-4 Coding Guide



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Code	Response
Correct Response	
10	Refers to the need for oxygen. *Examples: Fire does not get enough oxygen.* *The oxygen will be used up.*
11	Refers to the need for air. *Example: Fire does not get enough air.*
12	Refers to the need for air, using non-scientific language. *Examples: The fire will be "strangulated".* *The fire cannot breathe.*
19	Other acceptable.
Incorrect Response	
70	Refers to its getting too hot.
71	States that the gas (smoke, vapor, carbon dioxide...) is trapped inside the jar. *Example: The smoke cannot come out.*
72	Refers to the properties of the glass. *Example: The glass makes it cold.*
76	Repeats the information in the stem. *Example: The glass is placed over it.*
79	Other incorrect: *Example: You put it on too fast and the wind makes it go out.*
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

Q5. When an animal breathes faster and its heart beats faster, the animal is MOST likely

A. cold

B. frightened

C. resting

D. sleeping

Q-5

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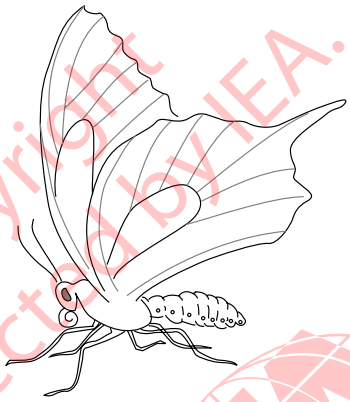
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	B	Life Science	Understanding Simple Information	73%	65%	484

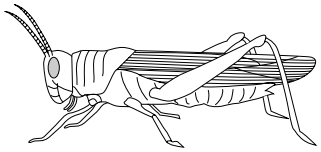
Q6. Which picture does NOT show an insect?

A.



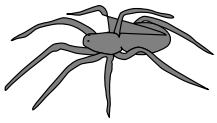
Butterfly

B.



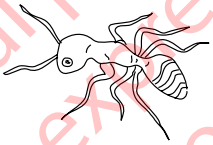
Grasshopper

C.



Spider

D.



Ant

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	C	Life Science	Understanding Simple Information	43%	41%	619

Q-7

Q7. Four children can feel and smell an object inside a bag, but they cannot see it. Which of the following is NOT an observation about the object?

A. "It is flat at one end and round at the other."

B. "It smells like peppermint."

C. "It has a bump on it."

D. "I hope it is candy."

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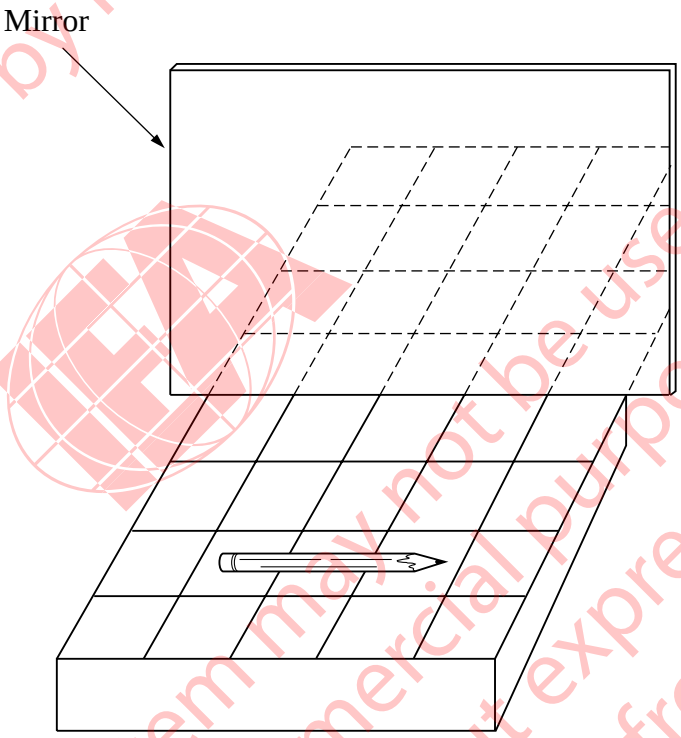
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	D	Environmental Issues and the Nature of Science	Understanding Complex Information	43%	34%	625

Q-8

Q8. The picture shows a pencil that is lying on a shelf in front of a mirror. Draw a picture of the pencil as you would see it in the mirror. Use the patterns of lines on the shelf to help you.



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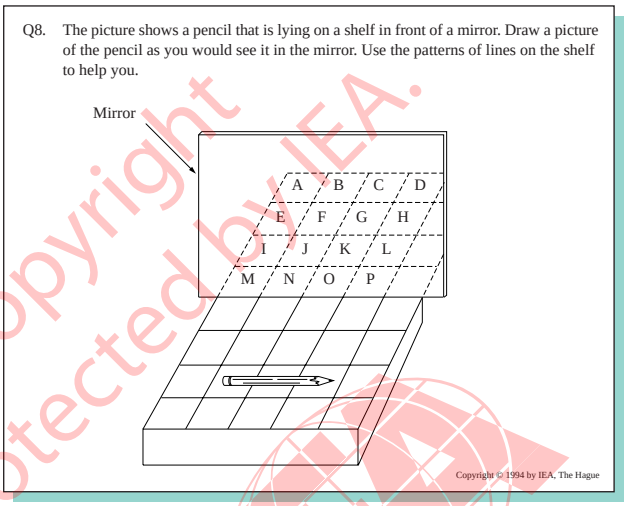
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Physical Science	Using Tools, Routine Procedures, and Science Process	47%	37%	599

Q-8 Coding Guide



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Note: In the codes listed below, the letters refer to squares which are covered by the image of the pencil. Pencil on the borderline should be accepted as correct.

Code	Response
Correct Response	
10	FGH; pencil point to the right.
11	FGH; point not shown.
12	FG or GH, (point to the right either shown or not shown) OR any other in the row E,F,G,H as long as the point is not clearly turned to the left.
Incorrect Response	
70	FGH, FG or GH, pencil point clearly turned to the left OR other in the row E,F,G,H.
71	Lists all or some part of the row: ABCD.
72	Lists all or some part of JKL; pencil point to the right may or may not be shown.
73	Lists all of some of the row MNOP, point to the right may or may not be shown.
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

Q9. Ken put a thermometer in a glass filled with hot water. Why does the liquid inside the thermometer rise?

A. Gravity pushes it up.

B. Air bubbles are released.

C. Heat from the water makes it expand.

D. Air pressure above the water pulls it up.

Q-9

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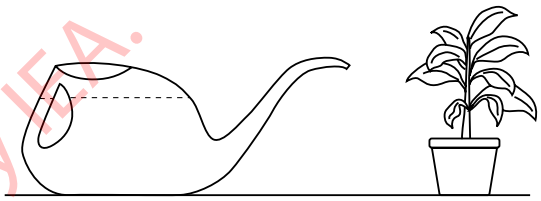
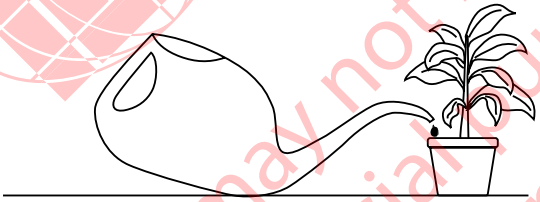
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	C	Physical Science	Using Tools, Routine Procedures, and Science Process	56%	45%	568

R1. A watering can is almost filled with water as shown.



The watering can is tipped so that the water just begins to drip through the spout.

Draw a line to show where the surface of the water in the can is now.



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R-1

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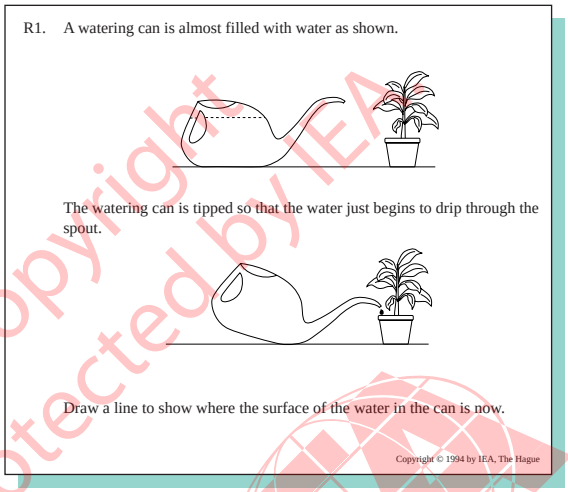
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Physical Science	Understanding Complex Information	21%	15%	755

R-1 Coding Guide



Note: For wrong answers (codes 70-79), the focus is on the angle of the water surface. The exact level (amount of water) is not important.

See illustration at right

Acceptable Range

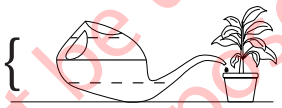


Figure 1
Code 10

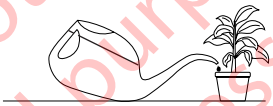


Figure 2
Code 71

Figure 3
Code 72

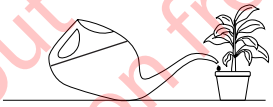


Figure 4
Code 73

Code	Response
Correct Response	
10	Approximately* horizontal level of water within allowable range (see Figure 1).
Incorrect Response	
70	Approximately* horizontal level of water. Higher or lower level of water than allowable range.
71	Water level is approximately* parallel to the bottom of the can (see Figure 2).
72	Water level clearly steeper than for code 71 (see Figure 3).
73	Water level is inclined in the opposite direction to that in codes 71 and 72 (see Figure 4).
79	Other incorrect: *Examples: Water in the spout only.* *Water only in the flower pot.*
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

*By "approximately" is meant within ca. 10 degrees. 

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R2. Some children were trying to find out which of three light bulbs was brightest. Which one of these gives the best START toward finding the answer?

A. "One bulb looks brightest to me, so I already know the answer."

B. "All the bulbs look bright to me, so there cannot be an answer."

C. "It would help if we had a way to measure the brightness of a light bulb."

D. "We can take a vote and each person will vote for the bulb he or she thinks is the brightest."

R-2

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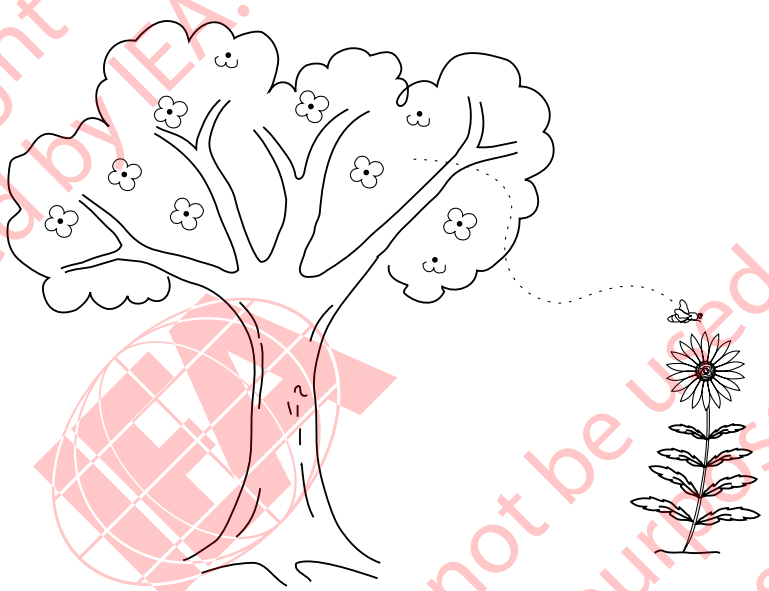
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	C	Environmental Issues and the Nature of Science	Using Tools, Routine Procedures, and Science Process	43%	33%	633

R3. The picture shows how an insect can carry pollen from the flowers of a tree to the flowers of a small plant.



Tree Plant

What will most likely happen?

A. The offspring from the tree will look like the plant.

B. The offspring from the plant will look like the tree.

C. The offspring from the plant will look like the tree and the plant.

D. Nothing will happen because no offspring will be produced.

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R-3

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	D	Life Science	Understanding Complex Information	55%	50%	553

R4. What is the MOST important reason for people to use a sunscreen when they are outside in sunlight?

A. It protects the skin against dangerous rays from the sun.

B. It makes the skin more tanned.

C. It makes the skin smooth.

D. It makes the skin feel cooler.

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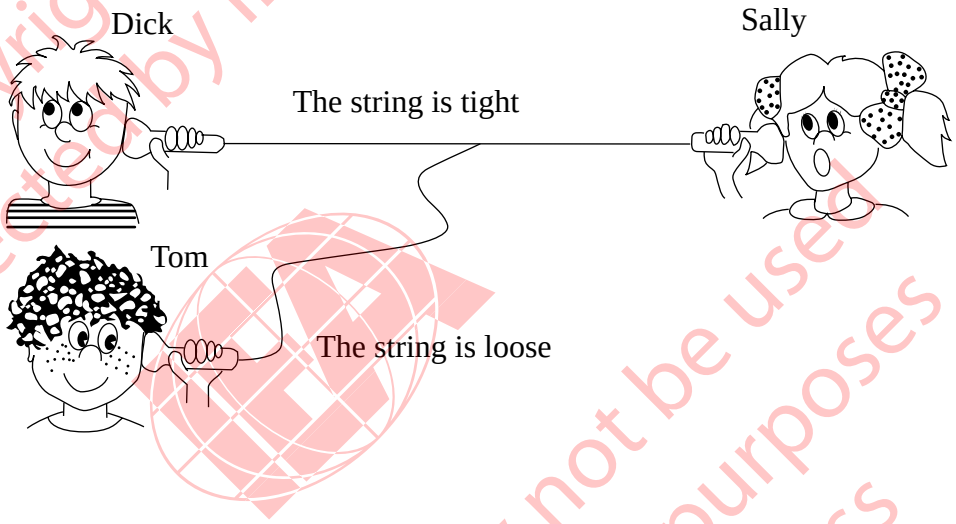
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	A	Life Science	Understanding Complex Information	76%	65%	458

R5. The picture shows Dick and his friends playing with a string-telephone. Sally is speaking. Dick and Tom are trying to listen. Which of them can hear her speak?



A. Both of them can hear equally clearly.

B. Neither of them can hear.

C. Only Tom can hear clearly.

D. Only Dick can hear clearly.

E. Both of them hear equally faintly.

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R-5

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	D	Physical Science	Understanding Complex Information	59%	49%	550

R6. Which one of these groups contains only animals with a backbone (vertebrates)?

A. Earthworm, snake, crayfish

B. Spider, clam, dragonfly

C. Crayfish, snake, horse

D. Clam, fish, earthworm

E. Horse, snake, fish

R-6

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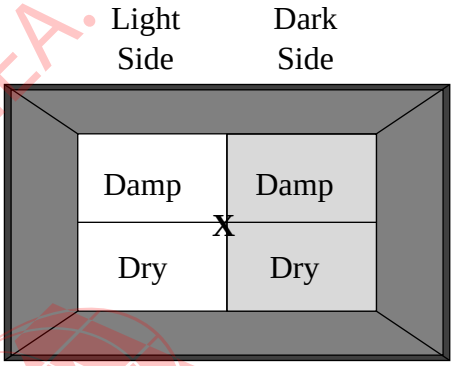
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	E	Life Science	Understanding Complex Information	46%	36%	629

R7. Here is a picture of the inside of a box. If you put a worm on the X on the bottom of the box, to which corner would you expect it to go?



A. Damp and light

B. Dry and light

C. Damp and dark

D. Dry and dark

R-7

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	C	Life Science	Using Tools, Routine Procedures, and Science Process	56%	45%	554

R8. Which makes its own light?

A. A mirror

B. A candle flame

C. A diamond ring

D. A magnifying lens

R-8

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	B	Physical Science	Understanding Simple Information	52%	46%	560

R9. One advantage of solar energy is that it

A. does not pollute

B. is not renewable

C. is efficient in any climate

D. is available at all times

R-9

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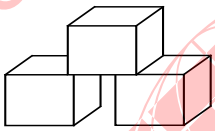
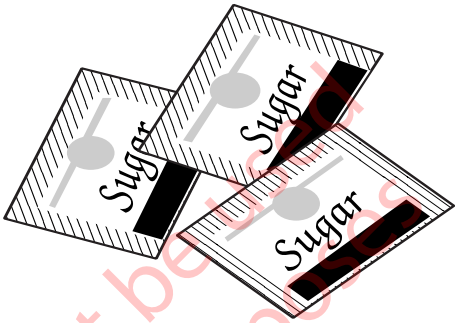
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	A	Physical Science	Understanding Simple Information	44%	35%	606

W1. The picture shows two forms of sugar — solid cubes and packets of loose crystals. One cube has the same mass of sugar as one packet.



Sugar Cubes



Loose Sugar

Which of the two forms of sugar will dissolve faster in water? _____
Give a reason for your answer.

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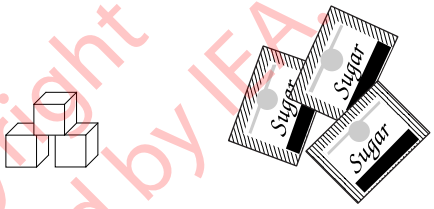
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Physical Science	Theorizing, Analyzing, and Solving Problems	37%	27%	641

W-1 Coding Guide

W1. The picture shows two forms of sugar — solid cubes and packets of loose crystals. One cube has the same mass of sugar as one packet.



Sugar Cubes Loose Sugar

Which of the two forms of sugar will dissolve faster in water? _____
Give a reason for your answer.

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Code	Response
Correct Response	
20	Loose sugar: explanation refers to size. *Examples: Because it is already in smaller pieces.* *Because it is smaller/thinner.* *Because it has thousands of individual crystals.*
21	Loose sugar: explanation refers to compactness of particles. *Examples: Because cubes are kept together.* *Because cubes are harder.*
29	Loose sugar. Other acceptable explanations.
Partial Response	
10	Loose sugar. No explanation.
11	Loose sugar. Explanation is inadequate. *Examples: Loose sugar is already loose and ready to dissolve.* *Loose sugar isn't in cubes.* *The cubes will take longer to dissolve.*
19	Other partially correct.
Incorrect Response	
70	Cubes. No explanation.
71	Cubes. Response indicates that loose sugar is already dissolved. *Examples: Because only cubes need to dissolve.* *Because a sugar cube is not already loose.*
72	Cubes. Refers to packaging. *Example: Because the cubes are not in a package.*
73	Cubes. Other explanations. *Example: Because the cubes are thicker.*
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

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W2. Write down one thing your heart does that helps the other parts of your body.

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W-2

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Life Science	Understanding Complex Information	40%	28%	638

W2. Write down one thing your heart does that helps the other parts of your body.

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Code	Response
Correct Response	
10	Explanation includes pumping blood in a circulating system out to the body and back to the heart.
11	Explanation includes pumping blood to all parts of the body. *Examples: It pumps blood and gives air to your lungs.* *It pumps blood to the other parts of your body.* *It pumps your blood.* *It pumps your blood around your body.*
19	Other correct.
Incorrect Response	
70	Refers to heart keeping us alive or similar expression. *Examples: Your heart gives you energy.* *Your heart gives you the strength to grow.* *It helps me breathe.*
71	Refers to heart keeping the beat.
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

W3. Write down the reason why we get thirsty on a hot day and have to drink a lot.

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W-3

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Life Science	Theorizing, Analyzing, and Solving Problems	27%	17%	707

W3. Write down the reason why we get thirsty on a hot day and have to drink a lot.

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Code	Response
Correct Response	
10	Refers to perspiration and its cooling effect and the need to replace lost water.
11	Refers to perspiration and only to replacement of lost water. *Example: Because when we are hot, our body opens the pores on our skin and we lose a lot of salt and liquid.*
12	Refers to perspiration and only its cooling effect.
13	Refers to perspiration only. *Examples: We are sweating.* *Your body gives away much water.* *We are sweating and get drier.*
19	Other acceptable.
Incorrect Response	
70	Refers to body temperature (being too hot) but does not answer why we get thirsty. *Example: You cool down by drinking something cold.*
71	Refers only to drying of the body. *Examples: Your throat/mouth gets dry.* *You get drier.* *The heat dries everything.*
72	Refers to getting more energy by drinking more water. *Example: You get exhausted.*
76	Merely repeats the information in the stem. *Examples: Because it is hot.* *You need water.*
79	Other incorrect: *Example: You loose salt.*
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

W4. The human brain is inside the skull. Write down one advantage of the skull being thick and strong.

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W-4

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Life Science	Theorizing, Analyzing, and Solving Problems	51%	33%	583

W-4 Coding Guide

W4. The human brain is inside the skull. Write down one advantage of the skull being thick and strong.

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Code	Response
Correct Response	
10	Refers to protection against concussion and injuries of the brain. *Example: It protects the brain. [or thoughts, memory....]*
11	Refers to protection of the "head." *Examples: It does not break as easily* *The head can withstand more*
19	Explanation includes other correct "advantages."
Incorrect Response	
76	Repeats information given in the stem. *Examples: The skull is so hard.* *Its so thick it makes it strong.*
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

W5. Write down two different things that people can do to help reduce air pollution.

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W-5

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One Way

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Environmental Issues and the Nature of Science	Understanding Complex Information	48%	31%	580

Two Ways

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Environmental Issues and the Nature of Science	Understanding Complex Information	34%	21%	659

W-5 Coding Guide

W5. Write down two different things that people can do to help reduce air pollution.

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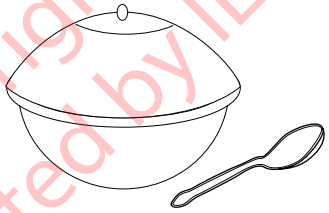
Note: Each of the two things must be coded separately.
The same code can be used twice. However, if the two things described are essentially the same, the second should be coded as 79.

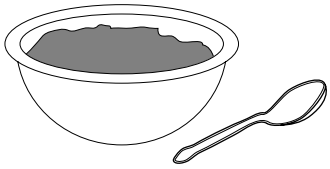
Merely mentioning causes of pollution does not receive credit.

Code	Response
Correct Response	
10	Refers to transportation and suggests a personal choice such as reduced use of airplanes, cars and motor boats or more walking, biking, public transportation, horseback riding, sailboats....
11	Suggests manufacturing changes. *Examples: Make cars, buses, etc. less polluting*
12	Refers to reducing use of fossil fuels: less burning of coal or oil.
13	Refers to reducing industrial pollution. *Example: Filter industrial waste.*
14	Student suggests planting or not cutting down trees/forest.
15	Refers to specific individual efforts. *Examples: Stop smoking.* *Stop using spray cans.*
19	Other correct.
Incorrect Response	
70	Student's response is vague and general. *Examples: Stop pollution* *Do the right things* *Clean everything* *Recycle* *Don't litter*
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

X1. Anna and Uri had identical bowls of soup, both at the same temperature. Anna put a cover on her bowl.



Anna's soup



Uri's soup

Whose soup do you think would stay hot longer? _____

Give a reason for your answer.

X-1

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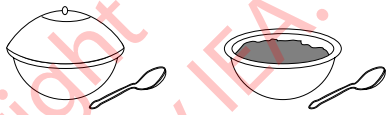
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Physical Science	Theorizing, Analyzing, and Solving Problems	47%	29%	626

X-1 Coding Guide

X1. Anna and Uri had identical bowls of soup, both at the same temperature. Anna put a cover on her bowl.



Anna's soup Uri's soup

Whose soup do you think would stay hot longer? _____

Give a reason for your answer.

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Code	Response
Correct Response	
20	Anna's soup. Mentions that heat or hot air does not escape Anna's soup or cold air does not enter it OR that heat (vapor, steam, smoke, etc.) disappears from Uri's soup or cold air enters it (or some combination).
29	Anna's soup. Other correct explanations.
Partial Response	
10	Anna's soup. Explanation refers to the cover. *Example: The soup with the cover.*
11	Anna's soup. Incomplete or incorrect explanation.
12	Anna's soup. No explanation.
19	Other partially correct.
Incorrect Response	
70	Uri's soup. Explanation is inadequate.
71	Uri's soup. No explanation.
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

X2. Write down one reason why animals could NOT live in a world without plants.

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X-2

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Life Science	Theorizing, Analyzing, and Solving Problems	77%	62%	453

X-2 Coding Guide

X2. Write down one reason why animals could NOT live in a world without plants.

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Code	Response
Correct Response	
10	Shows some understanding of food chain. *Example: Some animals need plants to eat and others depend on eating the animals.*
11	Mentions that plants are generally needed for food. *Example: Animals eat plants.*
12	Refers to plants "producing oxygen" or "cleaning the air". *Examples: If there were no plants, animals couldn't breathe.* *Plants give them air.*
13	Some combination of the above.
19	Other acceptable: *Example: Plants give animals shelter and a home.*
Incorrect Response	
76	Merely repeats information from the stem. *Example: Plants are needed.*
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

X3. Write as completely as possible why large oil spills in rivers and seas are harmful to the environment.

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X-3

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Environmental Issues and the Nature of Science	Understanding Complex Information	27%	16%	686

X-3 Coding Guide

X3. Write as completely as possible why large oil spills in rivers and seas are harmful to the environment.

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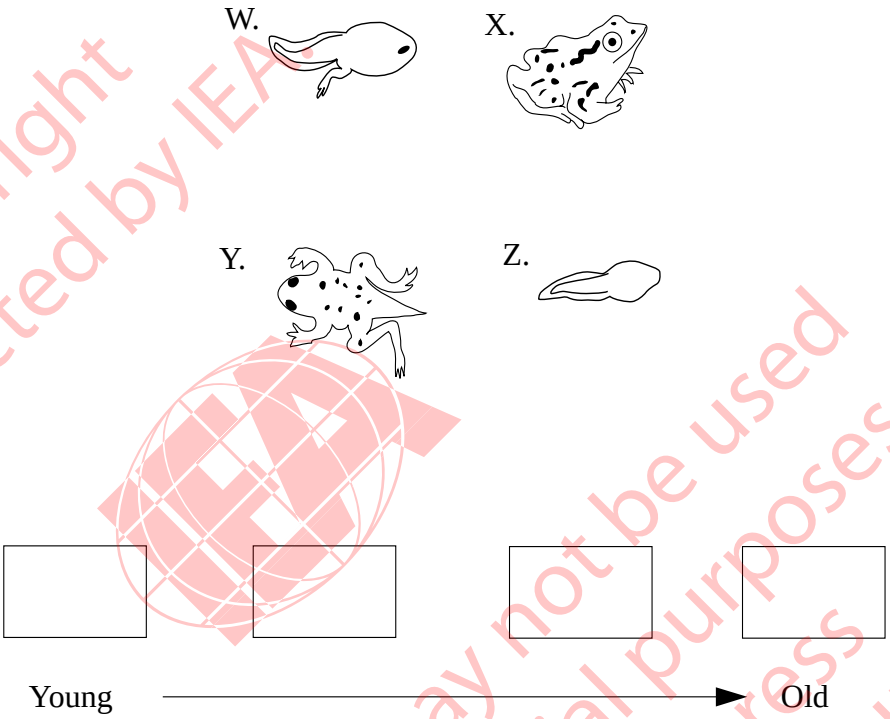
Code	Response
Correct Response	
20	Includes at least one the following elements with an explanation/elaboration: •Oil kills living things (plants, birds,...) •Water gets polluted •Air, and/or beaches get polluted *Examples: Because of oil in the water, the birds get oil in their feathers and then they cool down and die.* *Large oil spills are harmful because it goes on plants and animals. Animals may breathe in the odor and then plants and animals will die. Plants and animals are a big part of out wildlife. If plants die, so would we, because plants give us oxygen.*
21	Includes any combination of two or more of the elements in Code 20. *Example: Because it can kill animals and pollute rivers.*
29	Combinations of other acceptable consequences.
Partial Response	
10	Oil kills plants/birds, fishes, seals, crabs, or other organisms. *Example: Fish get killed.*
11	The water gets polluted (poisoned, covered by oil film).
12	Mentions that the air gets polluted.
13	Mentions that the beaches get polluted.
19	Other acceptable but incomplete.
Incorrect Response	
70	Refers to the source of the oil spill such as tank ships and motor boats.
71	Vaguely refers to otherwise correct elements, but without specification. *Examples: Oil is dangerous.* *Pollution*
72	Mentions that oil can cause a fire.
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

X4. The pictures show different stages in a frog's growth.



Write the letters in the boxes to show the pictures in the order of the frog's growth.

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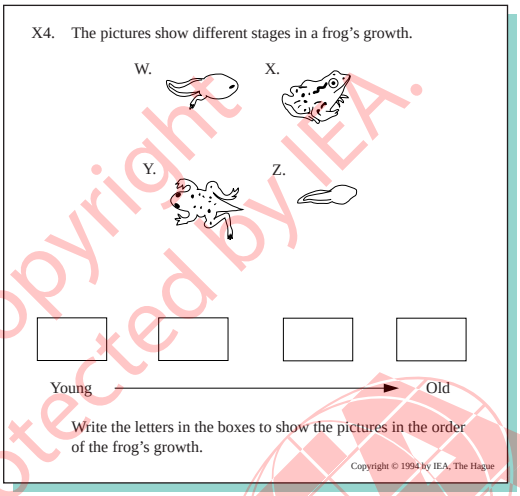
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Life Science	Understanding Simple Information	83%	71%	395

X-4 Coding Guide



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Code	Response
Correct Response	
10	ZWYX.
Incorrect Response	
79	Any other order.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
79	BLANK

X5. This chart shows four groups of animals. In which group do fish belong?

	Land Animal	Water Animal
Does have bones	A	B
Does not have bones	C	D

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X-5

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	B	Life Science	Understanding Simple Information	59%	48%	534

Y1. The Sun is bigger than the Moon, but they appear to be about the same size when you look at them from the Earth. Why is this?

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Y-1

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Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Earth Science	Theorizing, Analyzing, and Solving Problems	30%	21%	693

Y-1 Coding Guide

Y1. The Sun is bigger than the Moon, but they appear to be about the same size when you look at them from the Earth. Why is this?

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Code	Response
Correct Response	
10	Mentions that the sun is farther away than the moon. Comparative language is used. *Example: The moon is closer to the Earth.*
19	Other correct responses comparing apparent sizes.
Incorrect Response	
70	Includes some reference to the light. *Examples: The sun shines on the moon.* *The moon shines only in the night.*
71	States that the sun is closer than the moon.
72	Refers to distance, but response is general, not specified. *Examples: We are so far away from the sun.* *The distance is so long.*
73	Refers to the sun being higher up than the moon.
74	Other acceptable but incomplete or slightly erroneous responses.
76	Repeats the information in the stem. *Example: The sun is bigger than the moon.*
79	Other incorrect: *Examples: Because you are in the same place.* *Because the sun is rotating.*
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

Y2. Write down two changes that occur in children's bodies as they become adults.

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Y-2

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One Change

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	next page	Life Science	Understanding Complex Information	64%	52%	498

Two Changes

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	next page	Life Science	Understanding Complex Information	39%	28%	637

Y2. Write down two changes that occur in children's bodies as they become adults.

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Note: Each of the two ways must be coded separately.
The same codes can be used twice.

However, if the ways described are essentially the same, the second should be coded as 79.

Code	Response
Correct Response	
10	Refers to growth such as increases in height, weight, strength. . . . *Example: They get bigger.*
11	Refers to sexual maturation. Explanation may include secondary sexual features such as voice, hair....
12	Refers to appearance [Use code 10, 11 for those explicitly mentioned above.] *Examples: Their nails grow.* *Their hair might darken.*
19	Other acceptable: *Example: They lose teeth.*
Incorrect Response	
70	Refers to emotional or intellectual changes. *Examples: The don't cry* *Their minds expand in intelligence.*
71	Refers to social changes. *Examples: They can decide more themselves.* *They wear fashion clothes.*
72	Refers to changes associated with aging such as losing hair.
76	Repeats information in the stem, such as referring to children becoming adults. *Example: They get older.*
79	Other incorrect. *Example: Bones*
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

Y3. One way for animals to protect themselves is by escaping (running, flying, or swimming away). What are two other ways they protect themselves?

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Y-3

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One Way

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Life Science	Understanding Complex Information	60%	46%	510

Two Ways

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Life Science	Understanding Complex Information	42%	29%	611

Y3. One way for animals to protect themselves is by escaping (running, flying, or swimming away). What are two other ways they protect themselves?

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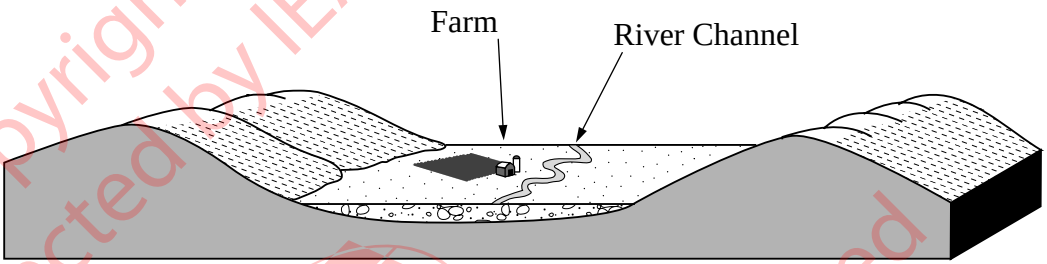
Note: Each of the two ways must be coded separately.

The same codes can be used twice.

However, if the ways described are essentially the same, the second should be coded as 79.

Code	Response
Correct Response	
10	Response includes general action such as defense, attack, fight. *Example: It can fight the animal.*
11	Response includes specific examples of offensive actions such as biting, scratching, goring, frightening, making noise.
12	Response includes specific examples of defensive actions such as camouflage or hiding, blending in, staying still, acting dead, etc.
13	Response includes structural features of the animal used in defense such as spines, shell, smell, being poisonous, and tasting bad.
19	Other acceptable: *Example: Use their special weapons.*
Incorrect Response	
76	Response repeats information in the stem or adds other ways of escaping. *Examples: Flying away* *Jumping away* *Climbing trees*
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

Z1. The diagram shows a river flowing through a wide plain. The plain is covered with several layers of soil and sediment.



a. Write down one reason why this plain is a good place for farming.

Z-1a

b. Write down one reason why this plain is NOT a good place for farming.

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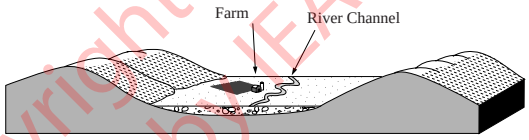
Part a

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Earth Science	Theorizing, Analyzing, and Solving Problems	62%	48%	537

Z1. The diagram shows a river flowing through a wide plain. The plain is covered with several layers of soil and sediment.



a. Write down one reason why this plain is a good place for farming.

b. Write down one reason why this plain is NOT a good place for farming.

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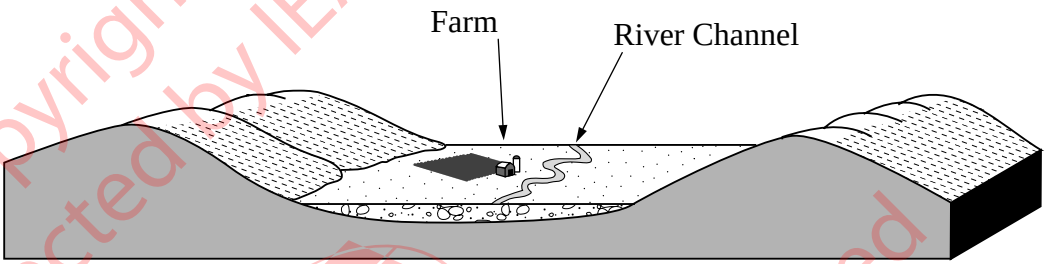
Part a: Codes for reason plain is a good place for farming.

Code	Response
Correct Response	
10	Mentions that the soil is fertile (good), abundant.
11	Mentions that there is a river (for irrigation, water for animals).
12	Mentions that there is plenty of space or flat areas for farm land.
19	Other correct: *Example: The goats can find grass in the mountains.*
Incorrect Response	
70	Does not address the issue of farming. *Examples: It is silent, a peaceful place to live.* *You can swim in the river.*
76	Merely repeats information in stem.
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

Z1. The diagram shows a river flowing through a wide plain. The plain is covered with several layers of soil and sediment.



a. Write down one reason why this plain is a good place for farming.

Z-1b

b. Write down one reason why this plain is NOT a good place for farming.

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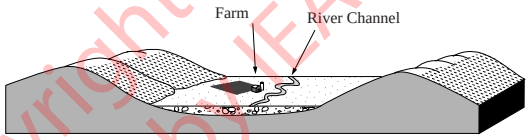
Part b

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Earth Science	Theorizing, Analyzing, and Solving Problems	23%	16%	743

Z1. The diagram shows a river flowing through a wide plain. The plain is covered with several layers of soil and sediment.



a. Write down one reason why this plain is a good place for farming.

b. Write down one reason why this plain is NOT a good place for farming.

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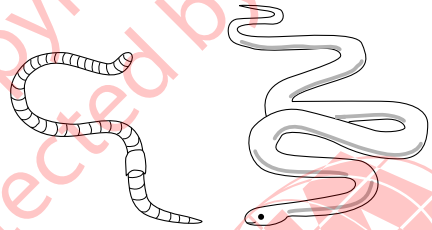
Part b: Codes for reason plain is not a good place for farming.

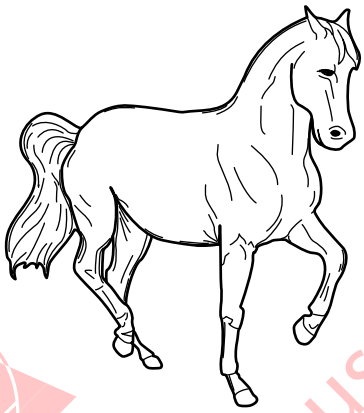
Code	Response
Correct Response	
10	Mentions the possibility of flooding, or that the soil will be too wet.
11	Mentions the possibility of wind or water erosion.
19	Other correct: *Examples: They might not get a lot of sunlight.* *The farmer would have to climb the hills to sell or trade his meat, vegetables, or fruit.* *It might be in the rain shadow of one of the mountains or hills.*
Incorrect Response	
70	Mentions that it is an undesirable place to live: boring/lonesome/ugly... *Example: Too far from the city.*
71	Does not address the issue of farming. *Example: The river is dangerous [for children].*
72	Refers to problems due to surrounding mountains. *Examples: Avalanches (snow or rocks) from the mountains.* *Goats get lost in the mountains.*
73	Refers to sediment, soil, being rocky and negative.
76	Merely repeats information in stem.
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

Z2. Use the pictures to answer the questions. (Use each animal once only.)

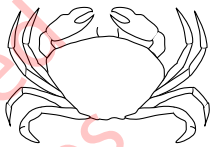


an earthworm

a snake



a horse



a crab

An animal that has a hard outside skeleton is

_____

An animal without a backbone that has many segments to its body is

_____

An animal that has hair and an inside skeleton is

_____

An animal that has a scaly skin and an inside skeleton is

_____

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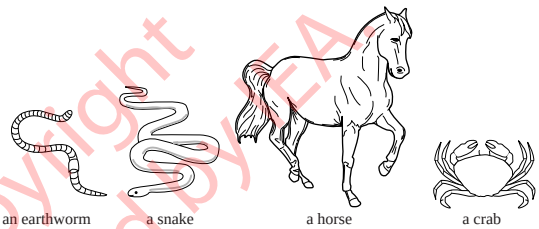
Z-2

Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Life Science	Understanding Simple Information	62%	52%	514

Z-2 Coding Guide

Z2. Use the pictures to answer the questions. (Use each animal once only.)



an earthworm a snake a horse a crab

An animal that has a hard outside skeleton is

_____

An animal without a backbone that has many segments to its body is

_____

An animal that has hair and an inside skeleton is

_____

An animal that has a scaly skin and an inside skeleton is

_____

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Code	Response
Correct Response	
10	Crab - Earthworm - Horse - Snake in this order.
11	One or more general terms are used, in the correct order, for the above organisms. (Crustacean, Reptile, etc.)
Incorrect Response	
70	No correct answers.
71	Only crab and horse are correct.
72	Any other two or three are correct.
73	Only crab is correct. Only horse is correct. Only earthworm is correct. Only snake is correct.
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

Z3. The weights of three blocks were compared.

Which one of the three blocks weighs the most? (A, B, or C): _____

Explain your answer.

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Z-3

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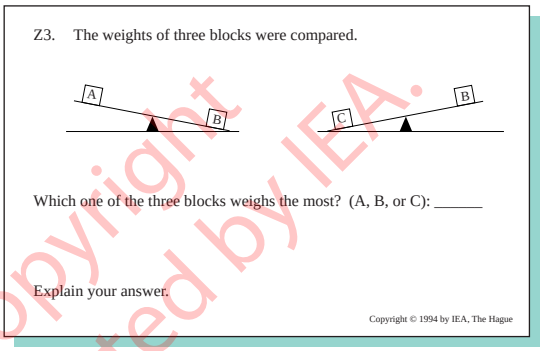
Subject	Item Key	Content Category	Performance Expectation	International Average Percent of Students Responding Correctly		International Difficulty Index
				Upper Grade	Lower Grade	
Science	Next Page	Physical Science	Theorizing, Analyzing, and Solving Problems	37%	24%	640

Z-3 Coding Guide



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Code	Response
Correct Response	
20	C. Because B is heavier than A and C is heavier than B, or any equivalent expression.
Partial Response	
10	C. Explanation is inadequate. *Examples: Because B is higher up.* *C. because it can be seen from the figure(s).* *C. Because it could lift up B.*
11	C. No explanation.
12	The wrong block is chosen but the explanation is correct.
19	Other partially correct.
Incorrect Response	
70	B. With or without explanation.
71	A. With or without explanation.
72	B and C. (Based on each of the two figures considered separately.)
73	All the blocks weigh the same.
79	Other incorrect.
Nonresponse	
90	Crossed out/erased, illegible, or impossible to interpret.
99	BLANK

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