Appendix F

Item Descriptions Developed During the TIMSS 2007 Benchmarking

Fourth Grade – Mathematics

Items at Low International Benchmark (400)

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>M08_01</td>
<td>Subtracts a three-digit number from another three-digit number.</td>
</tr>
<tr>
<td>M09_01</td>
<td>Adds a four-digit and a three-digit whole number.</td>
</tr>
<tr>
<td>M10_01</td>
<td>Identifies the number sentence that models a word problem involving subtraction.</td>
</tr>
<tr>
<td>M11_04</td>
<td>Finds the missing number in a number sentence involving multiplication.</td>
</tr>
<tr>
<td>M13_05</td>
<td>Solves a word problem involving addition of three-digit whole numbers.</td>
</tr>
<tr>
<td>M14_01</td>
<td>Identifies a four-digit number given in words.</td>
</tr>
</tbody>
</table>

Geometric Shapes and Measures

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>M01_09</td>
<td>Identifies two triangles with the same size and shape in a complex figure.</td>
</tr>
<tr>
<td>M07_09</td>
<td>Recognizes the inverse relationship between the size of a unit shown in a figure and the number of units required to cover an area.</td>
</tr>
<tr>
<td>M08_07</td>
<td>Identifies a pair of parallel lines.</td>
</tr>
<tr>
<td>M10_07A</td>
<td>Given the position, gives the informal coordinates of the position.</td>
</tr>
<tr>
<td>M10_07B</td>
<td>Given the informal coordinates, determines the position.</td>
</tr>
</tbody>
</table>
Data Display
M08_12 Completes a table from given information by counting.
M09_12 Completes a bar graph that represents a table of data.
M14_12 Identifies the largest increase shown in a bar graph.

Items at Intermediate International Benchmark (475)

Number
M01_08 Solves a measurement word problem involving subtraction of two-digit numbers.
M02_01 Identifies a set of two-digit numbers ordered from largest to smallest.
M02_05 Subtracts a number with one decimal place from another with one decimal place.
M04_01 Identifies a three-digit number described in units, 10s, and 100s.
M05_01 Identifies the appropriate operation to solve a word problem involving multiplication.
M05_04A Extends entries in two tables according to numerical rules described in a situation.
M06_01 Identifies the value of a digit in a four-digit number.
M09_05 Selects the expression that represents a situation involving addition.
M10_06A Extends a given geometrical pattern to determine a specified term.
M11_03 Generalizes from the first several terms of a numeric sequence to select another number that is also in the sequence.
M11_06 Extends a numeric sequence based on a geometric pattern.
M12_01 Identifies the rectangular model for a unit fraction.
M13_01A Selects appropriate information and uses it to solve a simple proportion problem.
M14_02 Solves a word problem involving multiplication of one-digit numbers.
M14_03 Identifies multiples of a given number.
Geometric Shapes and Measures
M04_06 Identifies an object with its line of symmetry shown.
M04_07 Draws a rectangle given two adjacent sides.
M06_08 Writes the names of three familiar geometrical shapes.
M07_06 Recognizes that area does not change when the parts of a figure are rearranged.
M07_10 Recognizes the triangles in a set of polygons.
M09_10 Orders four angles by size.
M09_11 Identifies a pattern generated by quarter turns clockwise.
M10_08 Draws the line of symmetry on a symmetrical polygon.
M11_10 Locates a point on an informal coordinate grid and identifies the moves to get there.
M13_06 Identifies a three-dimensional object given the pictorial representation of its faces.
M14_06A Identifies the shape made by connecting specified dots on a circle.
M14_06B Draws a specified geometrical shape by connecting dots on a circle.
M14_06C Draws a specified geometrical shape by connecting dots on a circle.

Data Display
M01_11 Identifies the pie chart that matches the information shown in a table.
M03_10 Completes a two-by-two table to summarize information.
M04_11 Completes a bar graph from information given in a table.
M05_09 Uses information to identify the number of symbols needed to complete a pictograph when the symbol represents more than one.
M06_13 Identifies the bar graph that shows a given piece of information.
M06_14 Identifies the bar chart that matches the information shown in a pie chart.
M07_12 Identifies the pie chart that matches a given bar graph.
M10_11 Identifies information from a pie chart.
M10_12 Identifies the bar chart that matches the information shown in a table.
M12_11 Interprets a bar chart to solve a problem.
M14_11 Interprets information in a table to solve a problem.
### Items at High International Benchmark (550)

<table>
<thead>
<tr>
<th>Number</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M01_01</td>
<td>Solves a word problem involving division of a three-digit number by a one-digit number.</td>
</tr>
<tr>
<td>M01_02</td>
<td>Determines the missing digit to give a specified difference in a three-digit subtraction problem.</td>
</tr>
<tr>
<td>M01_05</td>
<td>Solves a multistep word problem involving time and temperature.</td>
</tr>
<tr>
<td>M01_06</td>
<td>Solves a multistep word problem involving duration of time.</td>
</tr>
<tr>
<td>M01_07</td>
<td>Solves a word problem involving conversion of metric units of capacity.</td>
</tr>
<tr>
<td>M02_02</td>
<td>Identifies the operation needed to solve a problem involving division.</td>
</tr>
<tr>
<td>M02_03</td>
<td>Multiplies 2 two-digit numbers.</td>
</tr>
<tr>
<td>M03_06</td>
<td>Identifies a number that satisfies a number sentence involving division.</td>
</tr>
<tr>
<td>M04_04</td>
<td>Solves a word problem involving addition of two fractions with the same denominator.</td>
</tr>
<tr>
<td>M04_05</td>
<td>Identifies the operation needed to solve a problem involving division.</td>
</tr>
<tr>
<td>M05_02</td>
<td>Solves a word problem involving division of a three-digit number by a one-digit number.</td>
</tr>
<tr>
<td>M05_07</td>
<td>Solves a multistep word problem involving addition and multiplication of whole numbers.</td>
</tr>
<tr>
<td>M06_03</td>
<td>Shades half of a geometrical figure divided into four equal parts.</td>
</tr>
<tr>
<td>M06_04</td>
<td>Given five different digits, determines the smallest possible three-digit number.</td>
</tr>
<tr>
<td>M06_05</td>
<td>Writes a number between two consecutive whole numbers.</td>
</tr>
<tr>
<td>M07_01</td>
<td>Identifies the difference between two fractions with the same denominator.</td>
</tr>
<tr>
<td>M07_03</td>
<td>Selects the two-place decimal closest to a given whole number.</td>
</tr>
<tr>
<td>M07_04</td>
<td>Identifies the next term in a sequence of whole numbers formed by doubling.</td>
</tr>
</tbody>
</table>
M07_05 Identifies a number sentence that represents a situation involving division.
M07_07 Identifies the value of an unlabelled mark on a circular scale.
M08_02 Identifies the whole number closest to a given multiple of a hundred.
M09_06 Identifies the two-step rule for a linear relationship between the first and second numbers in a set of ordered pairs of numbers.
M09_07 Identifies the value of an unlabelled mark on a circular scale.
M09_09 Identifies the appropriate operation to solve a word problem involving division.
M10_02 Identifies the number that is a hundred more than a given four-digit number.
M10_04 Identifies appropriately rounded numbers in a multiplication situation.
M10_05 Identifies equivalent familiar fractions in a context.
M10_06B Extends a given geometrical pattern to find the value of a specified term.
M11_02 Solves a multistep word problem involving halving, doubling, and adding.
M11_08 Solves a word problem involving addition of time and conversion between hours and minutes.
M12_02 Uses knowledge of place value to solve a problem involving a five-digit number.
M12_04 Writes a fraction that represents a subset of a set of objects.
M12_05 Identifies the largest of a set of unit fractions.
M13_08 Solves a word problem involving measures and proportional reasoning.
M14_04 Adds 2 two-place decimals.
M14_05 Follows a rule to complete a table.
Geometric Shapes and Measures

M02_07  Determines the perimeter of a rectangle given its dimensions.

M02_08A  Uses two specified geometric tiles to make a four-sided figure.

M02_08B  Uses two specified geometric tiles to make a six-sided figure.

M02_08C  Uses two specified geometric tiles to make a different six-sided figure from one made previously.

M03_07  Determines the number of nonstandard units of area needed to cover a figure.

M03_08B  On a map drawn to scale, positions a building within a range of distance from a specified point.

M03_09  Given a figure and the line of symmetry on a grid, draws the reflection.

M04_09A  States a property that two shapes have in common.

M04_09B  States a property that two shapes do not have in common.

M06_07  Given a set of angles, identifies the right angle.

M06_09  Determines the number of cubes in a stack with some hidden.

M06_10  Given the line of reflection, draws the reflection of a given figure.

M06_11  Identifies the distance around a square given the length of one side.

M08_10  Identifies a net of a cube.

M08_11  Identifies the area of a right triangle drawn on a grid.

M11_09  Draws an angle greater than 90°.

M11_11  Identifies the figure in which a line of symmetry is shown.

M12_07  Identifies a pair of shapes which are not mirror images of each other.

M14_07  Identifies the number of edges of a solid shown in a picture.

M14_08  Determines the perimeter of a figure made of squares.
Data Display
M02_10 Completes the scale so that a bar graph shows information given in a table.
M02_11 Completes a bar graph to show a specified comparison.
M04_12 Reads a part symbol on a pictograph when the symbol represents more than one.
M05_04B Reads and interprets data from two tables to answer a question.
M05_04C Draws conclusions from data in two tables.
M08_13 Completes a bar graph from information given in a tally chart.
M11_12 Interprets data from a bar graph to solve a problem.
M12_12 Recognizes the bar graph labeled appropriately to show given information.
M12_13A Finds totals and decides which one is the least.

Items at Advanced International Benchmark (625)

Number
M01_03 Selects the appropriate information and uses it to solve a multistep word problem involving whole numbers.
M01_04 Writes two-step rule for a linear relationship between pairs of numbers.
M02_04 Identifies the fraction that is equivalent to the shaded fraction of a rectangle.
M02_06 Solves a two-step word problem involving two-place decimals.
M03_01 Solves a multistep word problem involving divisibility.
M03_02 Solves a problem involving proportional reasoning.
M03_03 Solves a multistep measurement problem involving multiplication and subtraction.
M03_04 Writes a rule for a multiplicative relationship between the first and second numbers in a set of ordered pairs of numbers.
M03_05 Identifies the two-step rule used to describe the relationship between adjacent terms in a sequence of numbers.
M04_02 Given a unit fraction, shows that fraction of a given set of objects.
M04_03 Identifies a fraction equal to a given fraction.
M06_02 Solves a word problem involving division and rounding up the remainder.
M06_06 Adds two familiar unit fractions to solve a word problem.
M07_08 Solves a multistep problem involving conversion between hours and minutes.
M08_03 Identifies the smallest number from a set of one- and two-place decimals.
M08_04A Identifies the circular representation of a nonunit fraction.
M08_04B Explains why a chosen circular representation shows a given nonunit fraction.
M08_05 Identifies the missing first number in a number sentence involving subtraction.
M08_06 Identifies the two-step rule that relates the numbers in two columns of a table.
M09_02 Identifies all the numbers in a given interval ending in a given string of digits.
M09_03 Halves the amounts in a recipe involving whole numbers and fractions.
M10_03 Finds all the factors of a multifactor number less than 20.
M11_01 Given a unit fraction, identifies a larger fraction with a different denominator.
M11_05 Identifies the number that satisfies a number sentence involving addition of two terms on each side.
M11_06C Generalizes from the first several terms of a numeric sequence to find the tenth term.
M12_03 Estimates the quotient of a four-digit number divided by a two-digit number.
M12_06 Solves a word problem involving proportional reasoning.
M13_01B Selects appropriate information and uses it to solve a proportion problem.
M13_01C Selects appropriate information and uses it to solve a multistep problem involving proportions.
M13_02 Selects appropriate information and uses it to solve a proportion problem.
**Geometric Shapes and Measures**

M02_08D  Uses three specified geometric tiles to make a seven-sided figure.

M02_09  Identifies a shape rotated by a 90° turn.

M03_08A  On a map drawn to scale, positions a park at a given distance from a specified point.

M03_08C  On a map drawn to scale, positions a building halfway between two specified points.

M04_08  Calculates the area of a rectangle.

M05_06  Recognizes that the area does not change when a figure is cut into parts and rearranged.

M05_08  Uses properties of rectangles and triangles to solve a problem.

M07_11  Recognizes the net of a triangular prism.

M08_08  Uses knowledge about properties of rectangles to classify statements as true or false.

M08_09  Solves a multistep word problem involving perimeter.

M09_08  Determines the area of a figure made up of squares and half squares on a grid.

M10_09  Uses knowledge of two common solids to classify statements about them as true or false.

M10_10  Matches a solid to its net.

M12_08  Determines the number of cubes in a given rectangular box.

M12_09  Identifies the area of an isosceles triangle drawn on a grid.

M12_10  Draws a line through a given point perpendicular to a given line.

M13_07  Identifies the position of a shape after a half-turn rotation.

M14_09  Estimates the length of a curved line in nonstandard units.

**Data Display**

M01_10  Organizes data and completes a tally chart to represent it.

M04_13  Uses data from two different graph types to solve a problem.

M12_13B  Draws and justifies a conclusion from data given in a table.
Appendix F: Item Descriptions Developed During the TIMSS 2007 Benchmarking

Items Above the Advanced International Benchmark (625)

**Number**

- **M05_03** Identifies the number that satisfies a number sentence involving division of two terms on each side.
- **M05_05** Solves a multistep problem to find one of the two unknown values.
- **M07_02** Subtracts a one-place decimal from a two-place decimal presented horizontally.
- **M13_03** Selects the appropriate information and uses it to solve a multistep problem involving two proportions.

**Geometric Shapes and Measures**

- **M04_10** Estimates a height using a nonstandard unit.
- **M06_12** Classifies polygons according to two given properties they either have or do not have.
- **M11_07** Estimates the length of a curved line next to the middle of a ruler.
- **M14_10** Draws all four lines of symmetry in a nonstandard shape.

**Fourth Grade – Science**

**Items at Low International Benchmark (400)**

**Life Science**

- **S13_03** Recognizes that wings are common to bird, bats, and butterflies.
- **S11_07** Recognizes that birds sit on their eggs to keep the eggs warm.
- **S13_01** Recognizes wolf as a predator.
- **S14_11** States one effect the sun can have on unprotected skin.
- **S07_04** Recognizes from diagrams of animals which animal is most likely to live in a desert.
- **S12_01** Completes a table by matching diagrams of animals to their ecosystems.
- **S02_05** Recognizes that the lung is the body organ most harmed by smoking.
Physical Science
S04_06 Recognizes that an iron object is most likely to be heavier than a wood or styrofoam object of the same shape and size.
S10_01 From a diagram, recognizes which thermometer reading shows the hottest water.
S14_09 Recognizes that the vibrations that produce sound in a guitar start with the strings.
S06_01 Identifies wind as the cause of movement in a sail boat.
S12_06 Identifies ice as the solid form of water.
S07_06 Recognizes that iron nails rust.
S14_07 From a diagram, identifies the direction of the force of Earth’s gravity.

Earth Science
S03_09A States the names of two seasons.

Items at Intermediate International Benchmark (475)

Life Science
S05_01 Recognizes that snakes shed their outer covering as they grow larger.
S04_05 In the context of an investigation of plant growth, describes a treatment that can cause one plant to grow better than another.
S12_02 Describes one way people can protect their teeth from decay, in addition to brushing.
S02_01 From a diagram, distinguishes non-living things from living things.
S08_01 Recognizes the stomach as an organ where digestion takes place.
S14_01 Recognizes that the function of seeds is to produce new plants.
S11_03 From pictures of animals, pairs each animal with its distinguishing biological characteristics (skeleton, milk production, number of legs).
S09_05 Recognizes that tadpoles hatch from frogs’ eggs.
S01_05 Recognizes that a person’s hair type can be predicted by his/her parents’ hair type.
Appendix F: Item Descriptions Developed During the TIMSS 2007 Benchmarking

S05_03 Recognizes from diagram of birds which bird is most likely to eat mammals.
S09_02 Recognizes which foot structure belongs to a bird that lives in a pond.
S13_02 Recognizes that fat layers help keep a walrus warm.
S14_02 Recognizes that the body needs more oxygen during exercise.
S07_01 Recognizes that trees make their own food using sunlight.
S01_06 Interprets from a food chain that snakes eat voles.
S04_03 Recognizes that fruits and vegetables are the best source of vitamins and minerals.
S06_08 Describes how influenza can be passed from person to person.

**Physical Science**

S02_06 In the context of an investigation, recognizes that a floating body is lighter than bodies of the same shape and size that sink.
S03_07 From a diagram showing a person blowing into water using a straw, explains why bubbles rise to the top.
S09_08 From a list of common materials, indicates which of them will burn.
S01_02B Given a diagram showing that the color of a white shirt appears to be different under different colored light bulbs, infers its color under blue light.
S11_08 Recognizes that an iron nail can complete an electrical circuit and allow a bulb to glow.
S10_07 Identifies electricity as the energy source for three household objects shown in a diagram.
S13_07 States two things that electricity can be used for in daily life.
S03_05A States one way water in ice form is used by humans.
S03_05B States one way water in liquid form is used by humans.
Earth Science
S05_07 Explains why people should not drink water directly from oceans and seas.
S07_11 States two different things human use wood for.
S01_08 Orders diagrams showing ribbons on poles by decreasing wind strength.
S03_09B States one difference between two previously named seasons.
S05_08 States one difference between the sun and the moon.
S08_11 States two planets other than Earth that orbit the sun.

Items at High International Benchmark (550)

Life Science
S11_02 Recognizes that if the only remaining Siberian tigers are female, they will not be able to reproduce, and will die out.
S02_03 Complete a diagram showing the life cycle of a moth.
S04_02 Describes one way that seeds from a plant are dispersed.
S10_04 From a diagram of a food chain, identifies a predator-prey relationship.
S04_08 From information shown in a table, completes a food chain.
S06_06 Explains why traveling by bicycle is better for the environment than traveling by motorbike.
S14_06 From a list of human activities, identifies which have positive and which have negative effects on the environment.
S09_04 Recognizes that differences in light brightness cause eyes in one picture to look different from the eyes in a second picture.
S10_02 Recognizes that plants make food using energy from the sun.
S01_04 Recognizes that the teeth of monkeys are most like the teeth of humans.
S07_05 Recognizes from a picture types of seed that are scattered by wind.
S08_02 Recognizes from a diagram the part of a flowering plant that produces seeds.
S06_03 From a picture of a pond ecosystem, identifies three living and three nonliving things.

S05_04A States one physical feature or behavior of fish that distinguishes them from sea mammals.

S03_03 Using knowledge of teeth, identifies and explains which of two skulls shows an animal that ate plants and an animal that ate meat.

**Physical Science**

S02_08 Identifies a method of separating a mixture of iron filings and sand.

S05_05 Recognizes that the hotter the water the more sugar will dissolve.

S08_09B In the context of an investigation, states that candy dissolves faster in hot water than in cold.

S04_12 Completes a table by identifying examples of matter that exist as solid, liquid, or gas at room temperature.

S02_10 Explains why water disappears from a dish of water left in the sun.

S05_06A Describes how a liquid can be turned into a gas.

S05_06B Describes how a liquid can be turned into a solid.

S03_06 From a diagram showing a metal ruler heated at one end, recognizes the direction of heat transfer.

S11_05 Recognizes that metal conducts heat better than wood.

S06_10 From a table of properties of two materials, determine the identity of each.

S10_09 Given a diagram of three objects of different materials ordered by volume, justifies that objects with more volume do not necessarily weigh more.

S13_05 From a table showing the results of an experiment, identifies what was being studied in the experiment.

S08_09A In the context of an investigation, explains that candy dissolves faster when it is crushed into small pieces.

S11_04 Recognizes that fine salt dissolves faster in water than coarse salt and explains why.

S13_08 Recognizes that heat needs to be supplied for melting and boiling but not for freezing.
S01_01C  From an investigation of the effect of different colored light on the apparent color of a shirt, infers the color of an unknown light bulb.
S10_11  From a diagram, recognizes the direction of a shadow.
S12_04  Recognizes what causes a shadow to be formed.
S01_02A  Describes the results of an investigation involving white shirt seen under different colored light bulbs.
S02_07  From a diagram of an electric circuit, states why an unbroken bulb does not light up.
S09_10  From a diagram showing two magnets on carts with the magnet poles marked, describes what happens to the carts when they are moved close together and let go.
S12_11  Completes the labeling of the poles on magnets shown in a diagram.
S04_07  Recognizes an example of an object moving because of the force of gravity.
S07_07  From a diagram showing three powders, recognizes those likely to be mixtures.
S09_07  Recognizes that salt water is a mixture.
S02_09  Identifies an object that runs only on electricity.
S07_08  Given a set of diagrams, recognizes that ice melts most slowly in a closed container.
S11_09  Recognizes that gravity causes an object to fall to the ground.

Earth Science
S02_12  Recognizes that most of Earth’s surface is covered by water.
S10_13  Identifies that water that has had its salt removed so that it can be used as drinking water is most likely to come from the sea.
S07_09  Explains that early morning moisture can be due to condensation.
S06_13A  Describes one advantage of farming near a river.
S12_14  From a table showing temperature and cloud cover, identifies the place where it is most likely to snow.
S14_08  Recognizes that parts of animals that have hardened into rock are the best evidence that there were many kinds of animals on Earth that no longer exist today.
S04_10 Recognizes that a mountain side rock layer containing shellfish fossils was once part of a sea floor.
S10_10 States one form of energy Earth receives from the sun.
S13_10 Identifies the Earth, moon, and sun from a diagram.
S02_13A From a table showing planetary distance from the sun, identifies the planet closest to the sun.
S02_13B From a table showing planetary distance from the sun, identifies the planet most likely to have the lowest average surface temperature.

Items at Advanced International Benchmark (625)

Life Science
S05_04 States one physical feature or behavior of sea mammals that distinguishes them from fish.
S14_03 Recognizes examples of animals that take care of their young.
S07_02 Explains that the last surviving member of a species of a turtle cannot reproduce and gives a reason.
S06_09 Describes how migration increases the survival of birds.
S14_04 Recognizes an advantage to monarch butterflies of being poisonous to birds.
S10_03 States one thing a person can do to avoid catching flu from an infected person.
S12_09 Describes one physical change that can take place in a mammal as the weather gets cold.
S03_04 Recognizes that the energy needed to heal a cut comes from food.
S13_11 Describes two human activities that can lead to the extinction of animals.
S13_04 States one thing can cause the temperature of the human body to be higher than normal.
S02_02 Recognizes which animal has six legs.
S03_01 Recognizes a group of animals that are all mammals.
S04_01 From a diagram, recognizes an animal that has a skeleton on the outside of its body.
S08_06 Recognizes an animal that is classified as a mammal.
S08_03 Identifies the body covering that protects a reptile.
S10_06A From a diagram of a tiger skull, identifies a function of the canines.
S11_01 Recognizes from a list of animals that humans have a young form that looks most like the adult form.
S09_01 Recognizes from a list of foods that cheese is the best source of calcium.
S01_07 Evaluates and supports argument for the need for a balanced diet.
S12_07 Explains why people should drink a lot of liquid every day.

**Physical Science**
S02_11 Recognizes that, regardless of their size, ice cubes float in water.
S04_11 Given a jar containing balls of the same volume but made of different metals, names one property that can be used to separate the balls into different groups.
S14_12 Names a source of energy other than coal, oil, or natural gas that is used to produce electricity.
S01_01A Describes the results of an investigation involving a red shirt seen under different colored light bulbs.
S01_01B From an investigation of the effect of different colored light on the apparent color of a shirt, concludes that the shirt looks different under different lights.
S11_06 Names one thing that shows that sunlight is made up of different colors.
S12_03 Using information in a table about physical properties of familiar items, identifies another item whose physical properties match those of one of the items in the table.
S13_06 Recognizes the diagram that best shows how ice floats in water.
S14_05 Labels the freezing point of water on a diagram of a thermometer.
S08_09C In the context of an investigation, recognizes that more water in a solution makes a drink less sweet.
S14_13 Recognizes that burning results in new substances.
S08_10 From a list of familiar materials, recognizes the best conductor of heat.
S08_08 Given two electric circuits diagrams showing different battery configurations, explain which circuit will allow a bulb to light.

S06_02 Distinguishes objects that produce their own light from those that do not.

S10_08 From diagrams providing partial information about the weights of four cubes, draws a conclusion about the relative weight of one of the cubes.

**Earth Science**

S11_11 Recognizes a soil change due to natural causes.

S13_09 Recognizes that soil rich in decaying plants and animals makes plants grow.

S12_13 States two things that make up Earth’s crust.

S04_09 Recognizes the pie chart that shows the proportions of land and water on Earth.

S04_14 Recognizes a common characteristic of different types of desert.

S16_13B Describes one disadvantage of farming near a river.

S04_13 Provides an example of a natural resource, other than water, and describes its use.

S14_10 In the context of an investigation, explains why water does not fill a glass inverted in water but does fill it when the glass is tilted.

S10_12 Recognizes that the direction a river flows depends on the slope of the land.

S03_08 Recognizes that the moon is visible because it reflects the light from the sun.

S12_12 Recognizes how long it takes for Earth to orbit the sun.

S06_11 Recognizes how long it takes for Earth to rotate on its axis.

S08_12 From a diagram showing a shadow at different times of the day, explains why the shadow changed.
Items Above the Advanced International Benchmark (625)

Life Science

S04_04  States two characteristics that distinguish between living and nonliving things.

S12_05  States two characteristics that living things share, other than a need for water.

S06_05  Identifies a group of animals that contains only reptiles.

S05_02  States two reasons why humans need a skeleton.

S10_06B  From a diagram of a rat skull, identifies a function of the incisors.

S06_07  Identifies one function of fruit.

S06_04  From a diagram of a flowering plant, identifies numbered parts and states a function of each part.

S03_02  Predicts whether different types of plants can reproduce, and justifies the choice.

S07_03  Evaluates and explains the best experimental setup for investigating effect of salt on seaweed.

S02_04  Recognizes where plants get the energy to make food.

S08_04  Recognizes which living things make their own food.

S08_05  States one thing necessary to maintain good physical health and explains why.

Physical Science

S06_12  From a series of diagrams, identifies an unknown material as a gas based on its behavior in a closed container and justifies the answer.

S10_05  Recognizes a description of condensation.

S09_09  Determines changes in temperature when a hot object is put into cold water.

S01_03  Predicts and explains the color of a blue shirt under a blue light.

S12_08  Draws a conclusion about the relative weight of two objects made of different materials that both sink in water.
Earth Science
S11_10 Describes activities that require air.
S09_03 Describes two things people can do to avoid wasting water.
S07_10 Recognizes that fossils are evidence that land was once covered by the sea.
S09_11 Relates day and night on Earth to rotation on its axis.

Eighth Grade – Mathematics

Items at Low International Benchmark (400)

Number
M02_02 Multiplies a decimal by a power of ten.
M03_07 Multiplies a two-place decimal by a three-place decimal.
M03_11 Solves a word problem involving a proportion with unit ratio.
M04_01 Given a number in the millions in words recognizes the numeral.
M06_01 Given a three-place decimal recognizes the equivalent fraction.

Algebra
M10_05A Finds the next term in a simple number pattern.

Data and Chance
M02_12 Given a table of values, selects the graph that could represent the given data.
M03_08 Given a table of values for two variables, selects the line graph that could represent the given data.
M14_13 Uses information in a table to complete a bar graph.
Items at Intermediate International Benchmark (475)

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M01_01</td>
<td>Identifies a circular model of a fraction that best approximates a given rectangular model of the same fraction.</td>
</tr>
<tr>
<td>M01_02</td>
<td>Solves a word problem by adding numbers with up to three decimal places.</td>
</tr>
<tr>
<td>M01_06</td>
<td>In a word problem selects the approximate quantity remaining after an amount is decreased by a given percent.</td>
</tr>
<tr>
<td>M02_01</td>
<td>Identifies a set of five-digit numbers ordered from largest to smallest.</td>
</tr>
<tr>
<td>M03_01</td>
<td>Reads the value indicated by an unlabeled tick mark on a circular scale.</td>
</tr>
<tr>
<td>M03_03</td>
<td>Selects the smallest fraction from a set of familiar fractions.</td>
</tr>
<tr>
<td>M03_12</td>
<td>Solves a word problem about distance and time by finding the missing term in a proportion.</td>
</tr>
<tr>
<td>M03_13</td>
<td>Identifies the integer that gives a specified result when divided by a given negative integer.</td>
</tr>
<tr>
<td>M04_05A</td>
<td>Completes a table by solving a simple word problem.</td>
</tr>
<tr>
<td>M08_01</td>
<td>Recognizes the power of 10 of the divisor in a division of decimals.</td>
</tr>
<tr>
<td>M10_01</td>
<td>In a word problem, given a unit fraction of a measure identifies the whole measure.</td>
</tr>
<tr>
<td>M12_01</td>
<td>Knows simple exponential notation.</td>
</tr>
<tr>
<td>M12_03</td>
<td>Uses knowledge of the whole being 100 percent to solve a simple word problem.</td>
</tr>
<tr>
<td>M12_04A</td>
<td>Completes a table of equivalent proportions.</td>
</tr>
<tr>
<td>M13_01</td>
<td>Rounds two-place decimals to whole numbers.</td>
</tr>
<tr>
<td>M14_01</td>
<td>Solves a word problem involving multiplication of a fraction and a decimal.</td>
</tr>
<tr>
<td>M14_04</td>
<td>Identifies equivalent ratios.</td>
</tr>
</tbody>
</table>

**Algebra**

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M07_04</td>
<td>Selects the rule expressed in words that generates successive terms in a given number pattern.</td>
</tr>
<tr>
<td>M07_05</td>
<td>Solves a linear equation in one variable.</td>
</tr>
</tbody>
</table>
M11_04 Knows the meaning of a simple algebraic expression involving multiplication and addition.
M11_05 Identifies the algebraic expression that represents a situation, involving addition and multiplication.
M13_03 Extends number patterns derived from a sequence of geometric shapes.
M14_03 Recognizes the distributive property in evaluating an algebraic expression.
M14_07 Identifies the ordered pair of numbers that satisfies a linear equation.

Geometry
M02_11 Given its coordinates, determines that a point is in the second quadrant of the Cartesian plane.
M03_14 Determines the measure of the missing angle in a right triangle.
M04_11 Draws a triangle on a grid with twice the area of a given rectangle.
M05_05 Solves a word problem by comparing distances on a map drawn to scale with a given distance.
M07_10 Uses properties of an isosceles triangle to identify the coordinates of a point on a grid.
M09_11 Given a net of a three-dimensional object, completes a two-dimensional drawing of it from a specific viewpoint.
M10_10A Given instructions, locates points on polar grid.

Data and Chance
M02_13 Reads a bar graph to identify quantities which satisfy a given condition.
M03_02 Recognizes that the probability of an outcome of a single event is inversely related to the number of elements in the population of events.
M07_13A Identifies the straight line graph modeling a situation described in words.
M07_13B Interprets two straight line graphs and uses their intersection to solve a problem.
M08_15 Given a table of percentages, selects the pie chart that could represent the given data.
M08_16  Interpolates from a line graph to provide an estimated value.
M10_11  Given a situation, judges the chance of an outcome as likely.
M11_13A Selects the appropriate line on a graph and reads information from it.
M12_14  Given a situation, judges the chance of an outcome as unlikely.

Items at High International Benchmark (550)

**Number**

M01_09  Adds three fractions with different denominators which are less than 10.
M02_03  Uses knowledge of negative integers to produce the largest sum.
M02_05  Reduces an amount by a given percentage.
M04_02  Identifies the prime factorization of a number.
M04_05D Combines the information from intermediate solutions to solve a problem involving time.
M05_01  Identifies equivalent ratios in a problem setting.
M06_02  Selects the numerator of a fraction to make two fractions equivalent when one denominator is not a multiple of the other.
M06_03  Continues a pattern of number sentences involving subtraction of negative integers.
M06_04  Given the part and the whole can express the part as a percentage and vice versa.
M07_01  Solves a word problem by determining a number between two given numbers that is divisible by only one of two other given numbers.
M08_02  Recognizes the fraction equivalent to a percentage.
M08_03  Approximates the sum of 5 three-digit numbers to the nearest 100.
M08_04  Identifies the larger of two fractions with different numerators and different denominators and explains why it is larger.
M08_05  Writes a rule for a multiplicative number pattern involving negative numbers.
M09_01 Identifies the decimal number that is equivalent to the sum of two fractions whose denominators are powers of ten.
M10_02 Identifies the decimal number represented by a point between two consecutive whole numbers on a number line with only the whole numbers labeled.
M10_03 Uses the law of exponents to express a product.
M12_02 Reads the value indicated by a minor unlabeled tick mark on a circular scale, when the previous major tick mark also is unlabeled.
M12_04B Finds the unknown term in a proportion in a given situation.
M13_07 Identifies the prime factors of a given number.
M13_08 Uses percentages given in a pie chart to solve a problem.
M14_02 Uses knowledge of decimal place value to express a given sum as a decimal number.
M14_06A Selects and combines information from two sources to solve a multistep word problem.
M14_06B Selects and combines information from two sources to solve a multistep word problem.

Algebra
M02_06 Recognizes the simplification of an algebraic expression.
M02_07A Continues a pattern involving the sum of interior angles of polygons based on triangles.
M04_04 Identifies the expression that represents a multiplicative situation.
M04_06 Solves a linear equation given in a word problem.
M05_02 Recognizes the product of two algebraic terms in one variable that involves exponents.
M05_10 Identifies the linear equation represented by a set of ordered pairs given in a table.
M06_05 Recognizes the collection of algebraic terms involving exponents.
M06_06 Evaluates an algebraic expression in two unknowns.
M06_08 Uses the value of a given algebraic expression to find the value of a related algebraic expression.
M07_06 Identifies an algebraic expression to model a situation.
M08_06 Solves a simple linear equation in one variable with a mixed number solution.
M08_07 Finds a missing term in a nonarithmetic and nongeometric number sequence.
M08_08 Identifies the linear equation satisfied by two given values.
M08_09 Solves a proportion expressed algebraically.
M08_11A Adds two algebraic expressions and simplifies.
M09_05 Identifies the algebraic expression that represents a situation involving the sum of a constant term and a product.
M09_06 Uses a formula to determine the value of one variable given the value of the other.
M10_05B Finds a specific term in a simple number pattern.
M10_06 Uses the distributive law to identify an algebraic expression equivalent to a given one.
M10_07 Determines the solution to a pair of simultaneous equations.
M11_01 Solves a word problem by using patterns in a two-column table to determine the number in the second column that would correspond to a number midway between two entries in the first column.
M11_12 Identifies the quantity that satisfies two inequalities represented by balances in a problem situation.
M12_05 Identifies the equation of a line that passes through points shown on a graph.
M12_07 Finds the value of an algebraic expression involving parentheses and negative terms.
M12_08A Finds a specific term in a pattern presented numerically and geometrically.
M13_09 Given an interval containing a number, determines the interval containing the sum of that number and a whole number.
M14_05 Identifies the algebraic expression that represents a fraction of a variable.
M14_08 Identifies the equation that models a situation given in a word problem.
M14_09 Identifies values of two variables each satisfying a simple inequality.
<table>
<thead>
<tr>
<th>M01_03</th>
<th>Identifies a three-dimensional object after rotation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M01_05</td>
<td>Finds the perimeter of a square, given its area is a square number.</td>
</tr>
<tr>
<td>M02_09</td>
<td>Identifies a net of a cube.</td>
</tr>
<tr>
<td>M03_06</td>
<td>Uses knowledge of a straight angle to find the measure of an angle.</td>
</tr>
<tr>
<td>M03_15</td>
<td>Uses properties of angles to draw and label a figure.</td>
</tr>
<tr>
<td>M04_09</td>
<td>Identifies how a three-dimensional object would look from a given viewpoint.</td>
</tr>
<tr>
<td>M05_04</td>
<td>Calculates the volume of a rectangular prism by using appropriate measure from its nets.</td>
</tr>
<tr>
<td>M05_09</td>
<td>Uses the properties of a triangle and regular hexagon to find the measure of an angle.</td>
</tr>
<tr>
<td>M06_11</td>
<td>Uses properties of triangles to draw a triangle of given dimensions on a grid.</td>
</tr>
<tr>
<td>M06_12</td>
<td>Given the volume and two dimensions of a rectangular solid, finds the other dimension.</td>
</tr>
<tr>
<td>M07_08</td>
<td>Calculates the area of an irregular figure formed by two rectangles.</td>
</tr>
<tr>
<td>M08_12</td>
<td>Identifies a true statement based on the properties of parallel and perpendicular lines.</td>
</tr>
<tr>
<td>M08_13</td>
<td>Uses the angle properties of triangles and rectangles to find a missing angle.</td>
</tr>
<tr>
<td>M09_09</td>
<td>Determines the number of cubes needed to fill a hole in a given shape.</td>
</tr>
<tr>
<td>M09_10</td>
<td>Identifies the justification that a triangle is a right triangle using the Pythagorean theorem.</td>
</tr>
<tr>
<td>M09_12</td>
<td>Identifies the transformations used to produce a sequence of figures.</td>
</tr>
<tr>
<td>M10_10B</td>
<td>Determines the measure of an angle drawn on a polar grid.</td>
</tr>
<tr>
<td>M11_08</td>
<td>Visualizes the unfolded shape of a figure shown on a folded piece of paper and uses properties of triangles to identify the shape.</td>
</tr>
<tr>
<td>M11_10</td>
<td>Applies properties of interior and exterior angles of a triangle to find an unknown angle in overlapping triangles.</td>
</tr>
</tbody>
</table>
M12_09  Draws a symmetrical shape given half of it and one of its lines of symmetry.
M12_11  Identifies two shapes that make a square.
M14_11  Given a cube made of unit cubes, uses the properties of a cube to identify the number of remaining unit cubes.

Data and Chance
M01_07  In a word problem, when given the possible number of outcomes and the probability of successful outcomes, solves for the number of successful outcomes.
M02_14  Uses the information in a pie chart showing percentages to draw a bar chart.
M04_12A Calculates and compares the means of two sets of numbers given their totals.
M04_13  Given a word problem, determines the most likely outcome.
M05_07C Draws conclusions from data in a table to meet given conditions.
M05_08  Compares and integrates several sets of data to determine which meet given conditions.
M06_14  Determines which of a set of statements involving averages must be true.
M06_15  Determines the probability of two of three possible outcomes.
M06_16  Uses data given as percentages to predict the outcome of a future event.
M06_17  Constructs and labels a pie chart representing a given situation.
M07_11  Uses experimental data and an understanding of probability to draw the spinner that could have produced the given data.
M07_13C Reads values from two straight line graphs to solve a problem.
M09_13  Constructs and labels a pie chart representing a given situation.
M09_14  Identifies the statement that best describes the relative likelihood of two events.
M10_12A Calculates the mean of a set of numbers.
M11_13C Selects the appropriate line on a graph and determines the interval where the greatest change occurs.

M12_12 Reads values from two line graphs to solve a problem.

M12_13 Identifies a possible word representation for a part of a speed-time graph.

M14_14 Explains why a conclusion drawn from a given bar graph is incorrect.

### Items at Advanced International Benchmark (625)

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M01_11B</td>
<td>Given the dimensions of two rectangles, expresses the ratio of their areas.</td>
</tr>
<tr>
<td>M02_04</td>
<td>Given the total number and the ratio of the two parts, identifies the value of one part.</td>
</tr>
<tr>
<td>M03_05</td>
<td>Given the total number and the ratio of the two parts, finds the value of one part.</td>
</tr>
<tr>
<td>M03_09</td>
<td>Selects appropriate data to solve a problem involving operations with fractions that have different denominators.</td>
</tr>
<tr>
<td>M03_10</td>
<td>Solves a word problem involving multiplication of a proper fraction and an improper fraction.</td>
</tr>
<tr>
<td>M04_05B</td>
<td>Given an average speed and distance, finds the duration and uses it to solve a problem.</td>
</tr>
<tr>
<td>M04_05C</td>
<td>Given an average speed and distance, finds the duration and uses it to solve a problem.</td>
</tr>
<tr>
<td>M07_02</td>
<td>Identifies a procedure for subtracting fractions with different denominators.</td>
</tr>
<tr>
<td>M07_03</td>
<td>Given the total number and the ratio of the two parts, identifies the value of one part.</td>
</tr>
<tr>
<td>M07_12</td>
<td>Given the original and reduced prices, finds the percentage of the reduction.</td>
</tr>
<tr>
<td>M09_02</td>
<td>Given two points on a number line representing unspecified fractions, identifies the point that represents their product.</td>
</tr>
<tr>
<td>M09_03</td>
<td>Solves a problem involving a fraction of a whole number of currency units.</td>
</tr>
<tr>
<td>M10_04</td>
<td>Arranges four given digits to obtain the greatest product of 2 two-digit numbers.</td>
</tr>
<tr>
<td>M11_02</td>
<td>Converts a mixed number to a decimal rounded to two places.</td>
</tr>
</tbody>
</table>
### Algebra

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M01_04</td>
<td>Solves a linear inequality involving a fraction.</td>
</tr>
<tr>
<td>M02_07B</td>
<td>Finds a specific term in a number pattern involving the sum of interior angles of polygons based on triangles.</td>
</tr>
<tr>
<td>M02_07C</td>
<td>Expresses the general term algebraically in a number pattern involving the sum of interior angles of polygons based on triangles.</td>
</tr>
<tr>
<td>M02_08</td>
<td>Solves a word problem that can be expressed as two linear equations with two variables.</td>
</tr>
<tr>
<td>M04_03</td>
<td>Evaluates an algebraic expression involving parentheses and negative terms.</td>
</tr>
<tr>
<td>M04_07</td>
<td>Simplifies an algebraic expression involving parentheses and negative terms.</td>
</tr>
<tr>
<td>M04_08</td>
<td>Given the equation of a straight line identifies a point on it.</td>
</tr>
<tr>
<td>M05_03</td>
<td>Extends a number pattern presented geometrically to solve a problem.</td>
</tr>
<tr>
<td>M06_09</td>
<td>Finds the missing term in a nonstandard number pattern.</td>
</tr>
<tr>
<td>M06_10</td>
<td>Identifies the linear equation that is satisfied by two ordered pairs.</td>
</tr>
<tr>
<td>M08_10A</td>
<td>Writes an equation to model a situation involving perimeter.</td>
</tr>
<tr>
<td>M08_10B</td>
<td>Solves a linear equation.</td>
</tr>
<tr>
<td>M08_11B</td>
<td>Subtracts one algebraic expression from another and simplifies.</td>
</tr>
<tr>
<td>M09_04</td>
<td>Identifies a diagram that models addition of two like algebraic terms.</td>
</tr>
<tr>
<td>M10_05C</td>
<td>Expresses the general term algebraically in a simple number pattern.</td>
</tr>
<tr>
<td>M10_08</td>
<td>Given the length of the sides of a rectangle in terms of a variable, identifies the algebraic expression for its area.</td>
</tr>
<tr>
<td>M11_03</td>
<td>Adds three simple algebraic rational expressions with different numerical denominators.</td>
</tr>
<tr>
<td>M11_09</td>
<td>Identifies the sum of three consecutive whole numbers given the middle number in general terms.</td>
</tr>
<tr>
<td>M12_06</td>
<td>Identifies the equation that models a situation involving distance, speed, and time.</td>
</tr>
<tr>
<td>M12_08B</td>
<td>Explains how to find a specific term in a pattern presented numerically and geometrically.</td>
</tr>
</tbody>
</table>
M12_08C Expresses the general term algebraically in a pattern presented numerically and geometrically.

M13_04A Extends a number pattern presented geometrically and numerically to solve a problem.

M13_04B Extends a number pattern presented geometrically and numerically to solve a problem.

M13_04C Extends a number pattern presented geometrically and numerically to solve a problem.

M13_05 Expresses the general term algebraically for two related number patterns.

M14_10 Uses a given formula to solve a word problem.

**Geometry**

M01_08 Uses properties of congruent triangles and the sum of the angles of a triangle to find the measure of an angle.

M01_11A Uses computation with fractions to find the length and width of a rectangle and draws and labels that rectangle on a grid.

M01_12 Finds the area of a triangle inscribed in a square with known dimensions.

M02_10 Uses properties of parallel lines and triangles to find the measure of an angle sum.

M03_04 Identifies the image of a triangle under a rotation about a point in the plane.

M04_10 Uses properties of isosceles and right triangles to find the measure of an angle.

M06_13 Identifies the image of a triangle under a rotation about a point in the plane.

M07_09 Solves a problem involving angle bisectors and angles at a point on a straight line.

M08_14 Uses properties of similar triangles to identify equal angles.

M09_07 Uses information about the lengths of segments on a line to determine the distance between their midpoints.

M09_08 Finds the perimeter of a square, given its area is a square number.

M10_09 Identifies the polygon that has a line of symmetry.
M11_06 Uses knowledge of time, clocks, and angles to solve a problem.
M11_07 Determines the area of a trapezoid inscribed in a rectangle.
M12_10 Uses the Pythagorean theorem in finding the perimeter of a trapezoid.
M13_06 Uses knowledge of interior angles of a triangle to determine the angle sum of a given polygon.
M14_12 Uses Pythagorean theorem in finding the area of a triangle.

Data and Chance
M04_12B Determines the truth of statements made about data shown in a scattergraph.
M05_07A Completes a table by interpreting several timetables to identify times that meet a given set of conditions.
M05_07B Derives information from given timetables to complete a table for a specified journey and check that it meets given conditions.
M10_12B Finds the median of a set of numbers.
M11_11 Given a spinner, identifies the expected frequency of a particular outcome.
M11_13B Interprets information from a line graph to determine an average.
M13_02 Solves a problem involving extrapolation of the data shown in a double bar graph.
M14_15 Uses understanding of average to solve a problem.

Items Above the Advanced International Benchmark (625)

Number
M01_10 Estimates the total time in minutes for an event made up of a series of events, each given in minutes and seconds.
M05_06 Calculates total costs for each of two groups given different unit costs and discounts.
M14_06C Compares information from two sources and explains the result.

Algebra
M06_07 Solves an inequality.
Appendix F: Item Descriptions Developed During the TIMSS 2007 Benchmarking

Geometry
M07_07 Uses knowledge of the area of a circle and of average rate to solve a problem.

Data and Chance
M10_12C Uses understanding of median and mean to solve a word problem.

Eighth Grade – Science

Items at Low International Benchmark (400)

Biology
S07_01 Identifies the circulatory system from a list of its components.
S04_01 Recognizes the cells that conduct messages.

Chemistry
S10_07 Recognizes the material that would complete an electric circuit.
S12_06 Recognizes the material that best conducts heat and electricity.
S10_01 Recognizes the chemical formula of carbon dioxide.

Physics
S07_06 Given the definition of work, identifies a diagram that shows that work is being done.
S08_06 Recognizes the form of energy in a compressed spring.

Items at Intermediate International Benchmark (475)

Biology
S08_05A Based on data in a table, describes the changes in the population of two organisms over time.
S01_08 Based on a completed food web, predicts and explains what is most likely to happen to a predator population when its prey population is reduced.
S02_02 Explains why exposure to influenza does not necessarily lead to infection.
Appendix F: Item Descriptions Developed During the TIMSS 2007 Benchmarking

S08_01 Recognizes how vaccination helps prevent illnesses.
S11_01 Recognizes which cells destroy bacteria that enter the body.
S11_04 States why exercise is important for good health.
S13_02 Explains that an acquired characteristic cannot be passed onto the next generation.
S05_09 Recognizes a characteristic that is found only in mammals.
S04_02 From a diagram, identifies an organ of the digestive system.
S12_01 Recognizes an organism that is a producer.
S04_05 Recognizes a disease caused by a virus.

Chemistry
S10_05 Recognizes from a description of indicator color changes that neutralization has occurred.
S10_11 Recognizes a chemical process involving energy absorption.
S07_05 Identifies vinegar as an acidic solution.
S12_04 In the context of an investigation, identifies the condition under which nails would rust most.

Physics
S03_05 Applies knowledge that sound requires a medium to travel through by contrasting a situation on Earth to a situation on the moon.
S14_10A Given a diagram showing a ball being thrown upwards, states the force that causes the ball to fall.

Earth Science
S06_13 Recognizes where active volcanoes are most likely to be found.
S01_06 Predicts a long-term effect of cutting down trees on the environment.
S08_13 Matches each of four processes that take place in the water cycle with descriptions of the processes.
S11_10 Given a starting point, orders the processes involved in the water cycle.
S13_13 Identifies paper from a list of common materials as the one that breaks down fastest.
S12_14 Recognizes what is caused by Earth rotating in its axis.
Items at High International Benchmark (550)

**Biology**

S02_01 Recognizes digestion from a description of the process.
S09_04 States one function of the uterus.
S14_02 Classifies animals in a list into two groups on the basis of a physical or behavioral characteristic and states the characteristic used.
S11_03 Compares two diagrams showing a pair of eyes and recognizes that more light results in smaller pupils.
S03_10 Recognizes the hierarchy of organization in living organisms (cell, tissue, organ, and organism).
S07_02 States one structure that is found in plant cells but not in animal cells.
S07_03 Given that chlorophyll is needed for photosynthesis, states two other factors that are needed.
S10_06 Given a graphical representation of the results of an investigation into the effects of light intensity and carbon dioxide concentration on the rate of photosynthesis, describes the relationship between carbon dioxide concentration and rate of photosynthesis.
S05_10 Recognizes that comparing genes can determine whether two people are related.
S04_03 In the context of an investigation comparing the growth of plants from genetically identical seeds under different conditions, predicts which plants will grow tallest and justifies the answer.
S13_03 Explains that camouflage helps snails avoid predators.
S01_08 Completes the food web of an ocean ecosystem based on information given in a table that lists a number of species and how they obtain their energy.
S14_04A Indicates in a table which gas is released into the air and which gas is removed from the air during animal respiration.
S06_05A  From a graph showing the population changes over time of two organisms, identifies the time when the population of one of the organisms is at its highest.

S11_02  Interprets a graph showing a sudden drop in the size of a population of an organism and recognizes that loss of food supply is most likely to have caused this sudden drop.

S14_04C  Indicates in a table which gas is released into the air and which gas is removed from the air during photosynthesis.

S08_05B  Based on data in a table showing population changes over time, concludes that there is a population decline and gives an explanation for this decline.

S08_02  Applies knowledge of ecosystems to explain why birds of prey cannot survive in an environment without plants.

S06_03  Applies knowledge of competition to explain the importance of removing weeds from a field where crops are sown.

S13_12  States how a volcanic eruption impacts the environment.

S02_03  Recognizes the food that contains the highest percentage of protein.

S05_13  Recognizes the type of food that should be avoided by a person without a gall bladder.

S06_01  Interprets a graph showing changes in pulse rates before, during, and after exercise and recognizes what can be concluded from the graph.

S05_07  Recognizes the main function of chlorophyll.

S03_03  Applies knowledge of the processes of photosynthesis and respiration to identify gases used up and given off by plants and animals in a forest ecosystem pictured in a diagram.

S12_05C  Recognizes an advantage for a species of butterfly to resemble another species of butterfly that is toxic to birds.
Chemistry

S08_08B In the context of an investigation about the gold content of jewelry, selects information from a table of properties of gold alloys to complete a table relating the density of alloys to number of carats and percentage of gold in each piece of jewelry.

S08_08C In the context of an investigation about the gold content of jewelry, uses previously selected information and follows an example to calculate the mass of gold in jewelry.

S07_04 Interprets data in a table of physical properties to identify iron, water, and oxygen.

S04_11A In the context of an investigation of density, interprets a table summarizing the methods used for measuring mass by four groups and explains why their results differed.

S11_06 Identifies a property of metals and describes how this property can be used to determine whether an unknown substance is a metal or nonmetal.

S06_06 Given the chemical formula for sulfuric acid, completes a table to show the number of atoms of each element in a molecule of the acid.

S12_08 In the context of an investigation, identifies which of two solutions is more dilute and justifies the selection.

S04_10 Recognizes that oxygen is necessary for burning.

S13_05 Explains what causes a balloon to inflate when sodium bicarbonate in the balloon mixes with vinegar.

S13_04 Recognizes the graph that most likely shows the effect of temperature on the solubility of sugar in water.

S03_02 Given a report of an experiment, distinguishes an observation from a prediction, conclusion, theory, or hypothesis.

Physics

S03_06 Based on a diagram demonstrating an investigation of thermal conductivity, recognizes that metal conducts heat faster than glass, wood, or plastic.

S06_10 Recognizes that molecules of a liquid slow down as the liquid cools.
Appendix F: Item Descriptions Developed During the TIMSS 2007 Benchmarking

S13_14 Recognizes that gas molecules move faster when temperature increases.
S12_07 Given a table showing speed of sound through different media, identifies the state of each medium and uses this information to recognize a conclusion that can be drawn from the table.
S03_11 Interprets data presented in a nonlinear distance vs. time graph.
S12_09 Recognizes why a helium balloon rises into the air.
S08_12 States the forces acting on students sitting on a wall.
S12_12 Explains why lightning is seen before thunder is heard during an electrical storm.
S03_04 Completes a table showing the relation between voltage and current.
S09_08 Identifies conduction as the process by which heat is transferred along a metal rod.
S05_03 Recognizes why the height of an alcohol column in a thermometer changes with increasing and decreasing temperature.
S14_07 Recognizes the pathway of light for an object to be seen.
S02_08 Recognizes how sound waves with large amplitude differ in energy and loudness from sound waves with smaller amplitude.
S14_08 Recognizes the object most likely to be used as a lever.

Earth Science

S09_10 Interprets a contour map to recognize a topographical representation of a mountain top.
S02_13 Describes how soil is formed.
S10_17 Explains how water evaporated from the sea ends up as rain on land.
S02_14 From a diagram showing the relative location of different towns and information about weather conditions in these towns, recognizes a prediction about future weather conditions.
S12_13 Describes what causes earthquakes.
S04_13 Describes one way groundwater can become polluted.
S04_14  Describes how trees can reduce soil erosion.
S05_11  Predicts one effect a new dam could have on wildlife.
S05_01  Recognizes the definition of an Earth year.
S05_06  Applies knowledge of the relative distances of the sun and
         the moon from Earth to explain why light from the moon
         reaches Earth in less time.
S04_15  Recognizes a nonrenewable resource.
S14_14  Recognizes a consequence of the gravitational pull of the
         moon on Earth.
S09_09  Recognizes the major cause of tides.
S08_09  Recognizes that carbon dioxide is increasing in Earth’s
         atmosphere.
S03_07  Given a diagram of Earth’s water cycle, recognizes the sun
         as the source of energy for the water cycle.
S11_11  Recognizes which soil change is due to a natural cause
         rather than human activity.
S13_10  Recognizes the main difference between planets and moons.

Items at Advanced International Benchmark (625)

Biology
S06_04  States a life function of a paramecium, other than taking in
         nutrients to produce energy.
S12_05B In the context of an observation of butterflies and plants,
         identifies a developing stage in the life cycle of an organism
         and describes what takes place during that stage.
S14_05  Using the equipment and materials shown in a diagram,
         describes an investigation to find out how fertilizer affects
         the growth of plants.
S12_05A In the context of an observation of butterflies and plants,
         identifies the growth stage in the life cycle of an organism
         and describes what takes place during that stage.
S02_05  Recognizes that a zygote is formed immediately after
         fertilization.
S01_09  From diagrams showing organisms that live in the intertidal
         zone, selects one organism, and explains how a physical
         feature or behavior helps the organism to survive low tide.
<table>
<thead>
<tr>
<th>Item Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S01_10</td>
<td>States two conditions that are found at the bottom of the ocean that make it difficult for most organisms to live there.</td>
</tr>
<tr>
<td>S04_06</td>
<td>Completes a diagram to show the direction of the energy flow in a food web.</td>
</tr>
<tr>
<td>S09_11</td>
<td>Based on demographic and other information about two countries, predicts how their population will change over time.</td>
</tr>
<tr>
<td>S09_11</td>
<td>Given a table showing demographic data and data on grain production and oil consumption for two countries, predicts how a change in population in each country will affect land use over the next 10 years.</td>
</tr>
<tr>
<td>S09_11</td>
<td>Given a table showing demographic data and data on grain production and oil consumption for two countries, predicts how a change in population in each country will affect pollution over the next 10 years.</td>
</tr>
<tr>
<td>S04_04</td>
<td>Describes two environmental problems likely to occur when a city doubles in population over a short time.</td>
</tr>
<tr>
<td>S07_12</td>
<td>States one reason why the human population increased rapidly over the last 200 years.</td>
</tr>
<tr>
<td>S06_05B</td>
<td>Interprets a graph showing the population changes over time of two organisms and describes how the changes in population sizes are related.</td>
</tr>
<tr>
<td>S13_06</td>
<td>Recognizes that vaccines provide the body with long-term immunity.</td>
</tr>
<tr>
<td>S10_02</td>
<td>Recognizes the function of a labeled part of a plant cell.</td>
</tr>
<tr>
<td>S13_01</td>
<td>Recognizes that the purpose of cellular respiration is to provide energy for cell activities.</td>
</tr>
<tr>
<td>S09_01</td>
<td>Identifies food source as a criterion for classifying animals into two groups.</td>
</tr>
<tr>
<td>S12_03</td>
<td>Recognizes an organism in which oxygen and carbon dioxide are exchanged between air and blood through the skin.</td>
</tr>
<tr>
<td>S10_03</td>
<td>Recognizes an organ in a frog that has a function similar to that of lungs.</td>
</tr>
<tr>
<td>S14_01</td>
<td>Recognizes a function shared by the lungs, skin, and kidneys.</td>
</tr>
<tr>
<td>S08_03</td>
<td>Recognizes a function of the cell membrane.</td>
</tr>
</tbody>
</table>
S06_02 Recognizes that the first organisms that appeared on Earth lived in water.

S09_02 Recognizes that organisms that are producers use energy from the sun to make food.

S11_13 Recognizes that the increase in algal growth in a lake is most likely due to fertilizer runoff.

**Chemistry**

S12_11 Applies knowledge of density to explain why oil floats on water.

S08_08A In the context of an investigation about the gold content of jewelry, describes the measurements to be taken using a graduated cylinder and water to find the volume of the jewelry.

S01_02 Based on an incomplete table comparing pure water and salt water, explains that addition of salt increases the density.

S05_12 Recognizes electrical conductivity as the criterion used for classifying materials into two groups.

S06_08 Recognizes the definition of a compound.

S14_09 Applies knowledge of expansion of water during freezing to explain why a bottle full of water cracked when it was left in a freezer.

S02_12 Explains that a chemical change in milk caused litmus paper to turn from blue to pink.

S06_11 Describes two things that might be observed as a chemical reaction takes place.

S12_10 Applies knowledge of conservation of mass during a neutralization reaction to explain what happens to mass when new substances are formed.

S05_05 Recognizes an example of a physical change.

S02_10 Applies knowledge of conservation of mass during a chemical reaction to explain what happens to mass when a new substance is formed.

S03_01 From a list of gases, identifies oxygen as the gas that causes rust formation.

S02_11 Recognizes a model showing the configuration of subatomic particles in an atom.
S11_05 Recognizes the concept map that best represents the particulate structure of matter going from molecules to atoms to subatomic particles (protons, neutrons, and electrons).

S09_05 Recognizes which diagram best represents the structure of water molecules.

S05_04 Recognizes that when sugar is dissolved in water, the sugar molecules continue to exist, but in solution.

**Physics**

S08_11 Describes how to distinguish between fresh water and salt water, using two hot plates but no thermometer.

S03_14 From a description of an experiment investigating the effect of dissolved salt on the freezing point of water, identifies the problem under investigation or states a conclusion based on prior knowledge.

S03_13 Applies knowledge of phase change and the boiling point of water to explain that the temperature of water does not exceed its boiling point despite the addition of heat.

S10_12 Identifies the characteristics or properties that change or remain the same as a liquid changes into a gas.

S05_08 Applies the principle of conservation of mass during phase change to explain why the mass of water remains unchanged after it is frozen.

S06_12B In the context of an investigation into the relative efficiency of two heat sources, identifies a variable that was controlled.

S06_09 Given two metal bars, one of which is a magnet, describes how to use the magnet to determine if the other metal bar is a magnet.

S04_09 From a diagram showing three magnets, explain why two of them are touching and why the third remains separated.

S11_09 Recognizes that the force of gravity acts on a person regardless of position and movement.

S02_15A In the context of an investigation about lifting blocks to build a pyramid, identifies the parts of an Egyptian lever, based on a model of the lever.
S05_02 Demonstrates an understanding that the surface of a liquid remains horizontal by drawing the level of the liquid on a frame-of-reference diagram depicting a tilted U-shaped container.

S10_14 On a diagram of a person looking through a periscope, draws the path and direction of a light ray through the periscope.

S07_08 Recognizes that plucking a guitar string harder causes the volume to increase but does not affect the pitch.

S13_09 Predicts the effect of removing air on the propagation of sound.

S13_07 Recognizes that when brought from a mountain top to a valley, a closed empty plastic bottle collapses because the air pressure in the valley is higher than on the mountain top.

S01_03 Recognizes that particles of a liquid move more slowly and are closer together than particles of a gas.

S07_07 Recognizes that mass is conserved during thermal expansion.

S06_12A Recognizes where to place a thermometer in a liquid to take a reading while conducting an investigation.

S13_08 Recognizes that railway tracks are laid down with gaps between lengths to allow expansion on hot days.

S02_07 Recognizes that the color of an object is the same as the color of the light waves that are reflected by the object.

S12_15 Recognizes that a shadow is shortest when the sun is overhead.

S09_07 Interprets a circuit diagram to recognize that the current flowing through two bulbs is the same.

S10_08 From a description of an investigation about magnets, recognizes how the strength of a magnet is defined.

S04_12 From a diagram showing different liquids layered in a beaker, recognizes an accurate statement about relative densities.

**Earth Science**

S09_10 Draws on a contour map the path and direction of a river flowing from a mountain to a bay.
S11_12 Describes changes in atmospheric conditions that occur with increasing elevation.
S01_05 Identifies and explains a physical process that can cause weathering of rocks.
S12_16 Draws an arrow on a map to show the direction a river flows and explains why it flows in this direction.
S03_09 States that sulfur dioxide produced by burning coal combines with water vapor in the atmosphere to form acid rain.
S05_14 Describes how science and technology can be used to address global warming caused by increased levels of carbon dioxide in the atmosphere.
S02_16 Provides a reason why recycling household materials is important.
S07_11 Interprets data in a table to describe the effect of amount of fertilizer on the yield of rice.
S01_01 Recognizes the percentage of total water on Earth that is fresh water.
S13_11 Given a diagram showing weather conditions at different elevations on a mountain, identifies the most likely location of a jungle.
S07_09 Relates the tilt of Earth’s axis as it orbits the sun to the seasons.
S08_14 Recognizes what causes the moon to appear to change shape.

Items Above the Advanced International Benchmark (625)

Biology
S02_06 Recognizes the likely classification of an animal with scales that uses only its lungs to exchange gases.
S02_04 Recognizes that the average body temperature of people living in hot climates is the same as those living in cold climates and provides a justification.
S03_12 Provides an explanation of why the heart beats faster during exercise.
S14_03 Recognizes which organelle produces energy for the cell.
S10_04 Recognizes an equation that summarizes the process of respiration.
S09_03 States two conditions needed for germination of seeds.
S12_02 Recognizes and describes an example of asexual reproduction.
S10_09 Designs an investigation to test a hypothesis about whether red and green peppers are produced by the same type of pepper plant.
S08_04 Recognizes an explanation for a change over time in a physical characteristic of an organism.
S14_04B Indicates in a table which gas is released into the air and which gas is removed from the air during plant respiration.
S01_07 Recognizes the graph showing increasing rate of human population growth over the last 200 years.

Chemistry
S04_11B In the context of an investigation of density, explains why two approaches to measuring the volume of an empty can gave different results.
S04_11C As part of an investigation of density of a metal can, interprets a table of mass, volume, and density to identify the method that determined the density of the metal of the can.
S14_12 Explains why ice will stay frozen in a wooden container longer than in a metal container.
S10_10 Classifies items as elements, compounds, or mixtures.
S14_06 Recognizes air as a mixture.
S02_09 Describes the steps used to separate salt from a mixture of salt, sand, and leaves, and provides a reason for each step.
S09_06 States one thing that could be observed that shows energy has been released during a chemical reaction.

Physics
S04_08 Recognizes a diagrammatic representation of the particles in a metal after heating.
S08_10 Recognizes that mass is conserved and volume increases as water freezes.
S11_07 Recognizes a sequence of energy conversions that takes place in a battery-operated flashlight.
S08_07 Interprets a diagram and describes the direction of heat flow in metals.
S10_13 Explains why an unwrapped block of ice will melt faster than a block of ice wrapped in newspaper.
S11_08 Interprets a diagram showing air and water in a sphere attached to a U-tube and explains that heating the air in the sphere can cause the water level in the open tube to rise.
S10_15 Recognizes that light travels fastest through a vacuum.
S04_07 Describes an advantage of using parallel rather than series electrical circuits in homes.
S14_11 Applies Ohm’s law to calculate resistance from current and voltage.
S01_04 Recognizes that an iron nail becomes magnetized when current flows through a wire coiled around the nail.
S14_10B Given a diagram showing a ball being thrown upwards, falling to the ground and bouncing, explains why the ball will not bounce to the height from which it fell.
S02_15B As part of an investigation about lifting blocks to build a pyramid, uses information shown in a diagram of a lever and applies a given formula to calculate the force needed to lift a block.

Earth Science
S07_10 Recognizes that most fresh water on Earth is located in the polar ice caps.
S01_05 Identifies and explains a chemical process that can cause weathering of rocks.
S06_07 Applies knowledge of condensation to explain why a liquid appeared on the outside of a pitcher of cold water.
S05_14 Describes how science and technology can be used to address oil spills in the oceans.
S06_14 Recognizes a diagrammatic representation of the sun, moon, and Earth during an eclipse of the moon.
TYPOGRAPHY: Set in Meridien, Minion, and Myriad.
PRODUCTION EDITOR: Debra R. Berger
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