

Appendix 14D: TIMSS 2015 Eighth Grade Science Item Descriptions Developed During the TIMSS 2015 Benchmarking

Items at Low International Benchmark (400)

Biology

S13_01	States one reason why male penguins' incubation behavior helps their eggs survive (1 of 2 points)
S14_01A	Uses a food web to identify which organisms are producers
S14_01B	Uses a food web to identify which organisms eat only plants

Chemistry

S07_06	Recognizes a material that best conducts both heat and electricity
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Physics

S12_15	Recognizes whether an electromagnet would attract objects made of various materials (1 of 2 points)
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Earth Science

S03_12A	Using a diagram, identifies what moves water from an artesian basin to the surface
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Items at Intermediate International Benchmark (475)

Biology

S02_03	Explains the advantage for a species of mice to have color matching its environment
S03_02	Matches 2 of 4 animal groups to their characteristic features (1 of 2 points)
S04_03	Recognizes characteristics inherited by rabbits in a given context
S04_04	Justifies an advantage of hollow bones for birds
S05_01	Identifies how vaccination helps prevent illnesses
S05_05A	Interprets information in a table to describe how the populations of two organisms changed over time
S06_01	Recognizes a living thing that has growth rings
S06_04	Recognizes from a list of foods which is the best source of calcium
S06_05A	Identifies why fish eat mosquito larvae but not adult mosquitos
S07_01	Recognizes an organism that is a producer

S07_05C	Identifies an advantage for a species of butterfly to resemble another species that is toxic to birds
S09_02	Analyzes information about an ecosystem and explains the effect of introducing a new population
S09_03B	Reasons how a crocodile's angle of vision helps it to survive in the environment
S10_01	Recognizes the process in the water cycle indicated in a diagram of an ecosystem
S10_02	States one substance plants obtain from their environment and use in photosynthesis (1 of 2 points)
S11_01A	Recognizes the agent that causes influenza
S12_04	Describes one characteristic of mammals that is advantageous for survival in cold weather (1 of 2 points)
S13_05	For pairs of animals, distinguishes between predatory and competitive relationships
S14_04	Recognizes the functions of 2 of 4 tissues found in the human stomach (1 of 2 points)

Chemistry

S07_04	Uses information from an investigation to recognize the condition under which nails would rust most
S08_01	Recognizes a chemical process that involves the absorption of light
S11_07	Recognizes an everyday occurrence that is an example of a chemical change
S13_07	Applies knowledge of concentration to explain why one solution is paler than another solution

Physics

S01_10A	Given a diagram showing a ball being thrown upwards, states the force that causes the ball to fall
S02_11	Uses information in a graph to recognize the motion of an object at five time points
S03_11	Recognizes the placement of a fulcrum that requires the least amount of force to move an object
S05_06	Recognizes the form of energy in a compressed spring
S08_09	Recognizes the type of energy change that occurs as a child slides down a slide
S14_06	Relates knowledge of density to indicate the order in which three liquids will settle after being poured in a beaker

Earth Science

S02_01	Recognizes whether 4 of 5 effects are a benefits of recycling paper (1 of 2 points)
S02_12	Recognizes a possible result of Earth's continents moving
S02_13	Describes one thing being done by car-makers to reduce air pollution (1 of 2 points)

S05_09	Recognizes a gas that is increasing in Earth's atmosphere
S06_14	Uses a diagram to state one advantage of a plant having roots that reach the subsoil (1 of 2 points)
S07_14	Recognizes an effect of Earth rotating on its axis
S13_11A	Uses information in a table with characteristics of planets to identify the planet with the shortest day length
S13_12	Recognizes the reason for cold temperatures outside an airplane in flight
S14_15	Synthesizes information in rainfall and temperature graphs to match 2 of 4 animals with the climate where they live (1 of 2 points)

Items at High International Benchmark (550)

Biology

S01_02	Classifies 6 of 7 animals into two groups, based on a stated physical or behavioral characteristic (1 of 2 points)
S01_04A	Indicates in a table which gas is released into the air and which gas is removed from the air during animal respiration
S01_04C	Indicates in a table which gas is released into the air and which gas is removed from the air during photosynthesis
S02_02	Recognizes the group to which an animal belongs given some of its features
S02_04A	Predicts the change in the amounts of two gases in the air as a result of an experiment on photosynthesis
S02_04B	Identifies 1 of 2 factors other than light intensity that could affect the rate of photosynthesis in an investigation (1 of 2 points)
S04_01	Recognizes what happens to an animal's cells as it grows
S04_02	Recognizes 2 of 3 major organs in a diagram (1 of 2 points)
S05_02	Explains why birds of prey cannot survive in an environment without plants
S05_05B	Draws a conclusion from population data in a table and gives a possible explanation for a change in population
S06_02	Identifies why birds puff up their feathers in cold weather
S06_06	Identifies parts of the human body as organ systems
S08_05	Selects and classifies 3 of 4 foods from a list that comprise a balanced diet (1 of 2 points)
S08_06A	Evaluates data from a table to draw a conclusion about the reason for a change in population of a species
S09_01	Recognizes which food is the best source of carbohydrates
S10_03	Recognizes why rabbits inherit traits that their parents do not have

S10_04A	Identifies one way that plant and animal cells are similar (1 of 2 points)
S11_02	Interprets a diagram to identify what happens to biceps and triceps when an elbow bends
S11_03	Recognizes a human characteristic that is acquired
S11_04	Explains how flooding leads to a shortage of drinking water or the spread of disease (1 of 2 points)
S12_01	Recognizes a list of food that comprises a healthy, balanced meal
S12_02	Explains why it is unlikely for someone to get sick with the measles a second time
S12_03	Identifies the conclusion best supported by a diagram of rock layers with embedded fossils
S12_04	Describes two characteristics of mammals that are advantageous for survival in cold weather (2 of 2 points)
S13_02	Recognizes an organism that is made up of cells with cell walls
S13_03	Recognizes how decomposers get their energy
S13_04	Given a food chain, explains which organism competes most with humans in a farming community
S14_02	Explains how a fossil can be classified as plant or animal, based on its cellular structure
S14_03	Predicts how heart rate changes in response to exercise, based on a set of given conditions

Chemistry

S03_05	Recognizes a property of most nonmetals
S05_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
S05_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
S06_07	From a table of melting and boiling points of three substances, identifies the state of each substance at a given temperature
S06_08	Given two proposed methods for separating a mixture of small pieces of two metals, identifies which method will work or why the other method will not work (1 of 2 points)
S06_09	Recognizes an everyday activity that is a chemical process that releases energy
S07_08	Identifies and explains which solution is more dilute than another in a given context
S08_02	Recognizes a model of a carbon dioxide molecule
S09_06	Recognizes and explains which substance will float on water using a table of densities
S09_08	Recognizes which process makes bronze dark and dull over time

S10_10	Recognizes which model best illustrates the results of a chemical reaction
S11_05	From a list of symbols and formulas, recognizes which are elements and which are compounds
S11_10	Explains the effect of temperature on diffusion in the context of an investigation
S12_06	Identifies the number of atoms of each element in nitric acid
S12_07	Use data in a table to order set-ups according to the rate at which a solute will dissolve in water
S14_11	Explains whether a reaction between two solutions in a given context can occur a second time

Physics

S01_07	Recognizes the pathway of light required for an object to be seen
S01_08	Recognizes an everyday object most likely to be used as a lever
S02_09	Explains whether a conclusion can be made about the relative strengths of two magnets in a given context
S04_05	Relates knowledge of heat transfer to recognize a graph that shows how two substances eventually reach temperature equilibrium
S05_12	Explains that there are forces acting on students sitting on a wall
S06_10	Recognizes the orientation of a hidden mirror given rays of light reflecting
S07_07	Uses a table showing the speed of sound through different media and knowledge of the state of each medium to recognize a conclusion that may be drawn about the relative speed of sound
S07_09	Recognizes why a helium balloon rises into the air
S07_12	Explains why lightning is seen before thunder is heard during an electrical storm
S09_10	Given the densities of two objects and three liquids, and diagrams showing the objects floating or sinking in the liquids, identifies each liquid
S10_07	Recognizes which graph represents a musical note with given specifications for volume and pitch
S10_08	Recognizes a free-body diagram that has a total force acting towards the right
S11_09	Recognizes how to increase the strength of an electromagnet
S12_14	Recognizes the type of energy transformation that occurs when a car begins to move from rest
S13_09B	Explains that in a parallel arrangement of two bulbs, one bulb failing does not affect the other bulb
S13_10	Recognizes the best explanation of why two bar magnets repel each other

Earth Science

S01_14	Recognizes a consequence of the gravitational pull of the Moon on Earth
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S04_13	Identifies a disadvantage of using solar energy
S04_14A	Recognizes the process that forms rock layers
S05_13	Matches each of four processes that take place in the water cycle with the description of the process
S06_13	Recognizes a non-renewable energy source
S07_13	Describes a cause of earthquakes
S08_11	Recognizes a major source of water for desalinization plants
S08_13	Uses a diagram of a mountain range on the ocean and a given wind direction to recognize which location will have the greatest rainfall
S09_13	Uses a graph of average monthly temperature to identify the city most likely to be located at the equator
S10_12	Describes one geographic factor to consider when selecting a safe location for a nuclear power plant
S10_13A	Relates information in temperature graphs and maps to recognize climatic attributes of two cities
S11_12	Recognizes the source of energy for the water cycle
S12_11A	Interprets information in a climate graph to determine the warmest and driest month of the year
S14_13	Identifies how the melting of permafrost can affect the Earth's climate
S14_14	Recognizes sources of fresh and salt water in a diagram
S14_15	Synthesizes information in rainfall and temperature graphs to match 4 of 4 animals with the climates where they live (2 of 2 points)

Items at Advanced International Benchmark (625)

Biology

S01_01	Identifies a function shared by lungs, skin, and kidneys
S01_02	Classifies 7 of 7 animals into two groups based on a stated physical or behavioral characteristics (2 of 2 points)
S01_03	Recognizes which organelle produces energy for the cell
S01_05	Designs an investigation to find out how fertilizer affects plant growth using equipment shown in a diagram
S03_01	Recognizes the function of shivering
S03_03B	In the context of an investigation about cellular respiration, identifies the gas produced and its source
S03_04	Explains why offspring are unlikely to have traits dissimilar to their parents

S05_03	Recognizes a function of the cell membrane
S05_04	Recognizes an explanation for a change over time in a physical characteristic of an organism
S06_03	Identifies the best conclusion supported by a diagram of limbs from different animals
S06_05B	Predicts the consequence for a prey population of increasing a predator population in a pond ecosystem
S07_02	Recognizes an example of asexual reproduction and describes the characteristics of asexual reproduction
S07_03	Identifies an organism in which gases are exchanged through the skin
S07_05B	Identifies and explains the stage of the life cycle during which a butterfly develops
S08_04	Applies knowledge about the theory of evolution to identify the best conclusion supported by a diagram of limbs from different animals
S08_05	Selects and classifies 4 of 4 foods from a list that comprise a balanced diet (2 of 2 points)
S08_06B	Selects and evaluates data from a table to draw a conclusion about the likely reason for a change in population of a species
S09_03A	Justifies a statement about crocodiles' adaptation to their environment, based on given facts
S09_04	States one similarity between the life cycles of a bird and a frog
S09_05	Identifies an explanation for disappearance of a trait over generations
S10_04A	Identifies two ways that plant and animal cells are similar (2 of 2 points)
S10_04B	States one way that plant and animal cells are different (1 of 2 points)
S12_05	Recognizes an example of a symbiotic relationship between two organisms
S13_01	States two reasons why male penguins' incubation behavior helps their eggs survive (2 of 2 points)
S14_04	Recognizes the functions of 4 of 4 tissues found in the human stomach (2 of 2 points)

Chemistry

S01_06	Recognizes a mixture
S02_05	Recognizes whether characteristics of substances are physical or chemical properties
S02_06	Recognizes a statement that best describes chemical reactions
S02_07	Determines the color that results after a pH indicator is added to four solutions based on information provided about the indicator
S03_06	Recognizes the reason for the difference in taste between distilled and drinking water
S04_08	Recognizes whether 4 of 5 substances are elements, compounds, or mixtures (1 of 2 points)

S04_10	Identifies and explains whether a described change is physical or chemical
S04_11	Explains whether a reaction took place after a pH indicator is added to a solution based on information provided about the indicator
S05_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
S07_10	Applies knowledge of conservation of mass during a neutralization reaction to explain what happens to mass when new substances are formed
S07_11	Applies knowledge of density to explain why oil floats on water
S08_03	Applies knowledge of density to identify and explain which liquid will leave a dropper first after a mixture separates
S09_07	Recognizes a property that is common to both acids and bases
S10_09	Explains the difference between a solid and air in terms of particle spacing in context
S10_11	Recognizes what happens to the atoms in an object pounded flat
S11_06	Identifies an element as a metal or a nonmetal, based on a list of physical properties and predicts one additional property
S13_06	Given their chemical formulas, recognizes a compound with the same number of atoms as another compound
S13_08	Recognizes an everyday process that is an example of a physical change

Physics

S01_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
S01_12	Applies knowledge of thermal conductivity to explain why ice will stay frozen in a wooden container longer than in a metal container
S02_10	Explains whether one person can see another person in a practical problem involving reflection of light from plane mirrors
S03_08	Given two unknown samples and using knowledge that only gases fill the available space, recognizes a statement about the spacing of particles in the samples
S03_09	Recognizes the relative temperatures of the outside surfaces of containers made of materials with different thermal properties
S04_06	Explains why a vehicle with tires is more likely to sink in the mud than a vehicle with treads
S04_07	Recognizes an explanation for why a ball appears a certain color in a given context
S05_07	Interprets a diagram to describe the direction of heat flow in metals
S05_11	Describes a way to distinguish between fresh water and salt water, using two hot plates and without using a thermometer
S06_12	Explains why one orientation of a rectangular block exerts the greatest pressure on the ground
S08_07	Recognizes which property of sound allows animals to navigate and find food



S08_10	Identifies and explains which of three methods will require the smallest force to move a heavy box onto a truck
S09_09	Recognizes why gases are easier to compress than solids and liquids
S10_06	Uses a diagram to explain one way to increase the strength of an electromagnet
S11_08	Recognizes the property of a gas in a dented ping pong ball that stays constant if the ball is heated
S11_11	Applies knowledge about the relationship between depth and water pressure to recognize a conclusion about the pressure at different depths
S12_13	Draws a conclusion about the states of substances in two pistons, based on the different amounts of compression that occurred
S13_09A	States one reason why a bulb in a diagram of an electrical circuit does not light
S13_09C	Recognizes a correct statement about battery life and bulb brightness in two given electrical circuits
S14_07	Recognizes whether a red object will absorb or reflect different colors of light
S14_08	Indicates whether parts of a light bulb are electrical conductors or insulators

Earth Science

S02_01	Recognizes whether each of five effects is a benefit of recycling paper (2 of 2 points)
S02_14	From diagrams involving the Earth, Moon, and Sun, identifies the one that explains the changing seasons
S03_12B	Identifies the cause of decreasing water flow in an artesian well over time
S03_12C	Explains why water from an artesian well can be hot
S05_14	Recognizes what causes the moon to appear to change shape
S06_14	Uses a diagram to state two advantages of a plant having roots that reach into the subsoil (2 of 2 points)
S06_15	Explains whether an object's weight is less on the Moon than on the Earth
S07_15	Recognizes how a shadow changes throughout the day
S07_16	Draws an arrow on a map to show the direction a river flows and explains why it flows in this direction
S09_12	States one condition below Earth's crust that can be inferred from volcanic eruptions
S09_14	Identifies an explanation for why a constellation visible one night is no longer visible six months later
S11_13	Explains one way trees protect soil from erosion
S11_14	Justifies a claim that the Moon travels around the Sun
S12_09	Recognizes how oil is formed on Earth

S13_11B	Synthesizes information from tables about revolution times around and distances from the Sun to infer relative distances of planets from the Sun
S14_12	Recognizes a negative effect that fertilizer can have on the environment

Items Above the Advanced International Benchmark (625)

Biology

S01_04B	Indicates in a table which gas is released into the air and which gas is removed from the air during plant respiration
S02_04B	Identifies two factors other than light intensity that could affect the rate of photosynthesis in an investigation (2 of 2 points)
S03_02	Matches 4 of 4 animal groups to their characteristic features (2 of 2 points)
S03_03A	In the context of an investigation about cellular respiration, interprets the role of parts of an experimental set-up to provide a controlled condition
S04_02	Recognizes 3 of 3 major organs in a diagram (2 of 2 points)
S07_05A	Identifies and explains the stage of the life cycle in which a butterfly grows
S08_06C	Predicts which species would best survive in a given environment, using information in a table, and provides a supporting explanation
S10_02	States two substances plants obtain from their environment and use in photosynthesis (2 of 2 points)
S10_04B	States two ways that plant and animal cells are different (2 of 2 points)
S11_01B	Explains how influenza can be spread rapidly around the world
S11_04	Explains how flooding leads to a shortage of drinking water and the spread of disease (2 of 2 points)

Chemistry

S03_07	Recognizes whether everyday liquids will neutralize a base
S04_08	Recognizes whether each of five substances is an element, a compound, or a mixture (2 of 2 points)
S06_08	Given two proposed methods for separating a mixture of small pieces of two metals, identifies which method will work and explains why it will work and why the other method will not work (2 of 2 points)
S12_08	Recognizes a property of a basic solution
S14_09	Explains how painting a metal prevents rust from forming
S14_10	Recognizes a true statement about neutral atoms

Physics

S01_10B	Recognizes that a falling ball will not bounce as high as the point from which it fell and explains why
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S01_11	Calculates resistance from current and voltage
S02_08	Interprets a diagram showing heat transfer to recognize the relative temperatures of two blocks in water
S03_10	From a diagram of an object floating in different liquids, explains that the portion of the object which is submerged depends on the density of the liquid
S04_09	Explains how a substance can be in two different states in a container at one time in a given context
S05_10	Recognizes what happens to the mass and volume of water when it freezes
S06_11	Recognizes the correct statement about the relative motion of an object seen from two frames of reference
S08_08	Recognizes how the temperature of water changes over time when heated
S10_05	Recognizes how the mass of a metal ball will change as it cools down

Earth Science

S02_13	Describes two things being done by car-makers to reduce air pollution (2 of 2 points)
S04_12	Recognizes the gas that makes up most of Earth's atmosphere
S04_14B	Given a diagram, explains a process that shaped a rock formation in the ocean
S10_13B	Synthesizes information in temperature graphs and maps to recognize an explanation for the difference in seasonal climates of two cities at similar latitudes
S12_10	Recognizes the relative composition of gases in Earth's atmosphere
S12_11B	Evaluates a conclusion about climate data, based on one week of weather observations