High School Proficiency Assessment (HSPA)

A Science Handbook: Open-Ended Questions

October 2005
PTM# 1505.54

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OCTOBER 2005
HIGH SCHOOL PROFICIENCY ASSESSMENT (HSPA)

SCIENCE HANDBOOK
OPEN-ENDED QUESTIONS

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HIGH SCHOOL PROFICIENCY ASSESSMENT (HSPA)
PROGRAM DESCRIPTION

In 1975, the New Jersey Legislature passed the Public School Education Act "to provide to all children in New Jersey, regardless of socioeconomic status or geographic location, the educational opportunity which will prepare them to function politically, economically and socially in a democratic society." An amendment to that act was signed in 1976 which established uniform standards of minimum achievement in basic communication and computation skills. This amendment is the legal basis for the use of a test as a graduation requirement in the State of New Jersey.

Beginning in 1981–82, ninth-grade students were required to pass the Minimum Basic Skills Test (Reading and Mathematics) as one of the requirements for a high school diploma. Students who did not pass both parts of the test had to be retested on those parts not passed.

In 1983, a more difficult test in Reading, Mathematics, and Writing was adopted, the Grade 9 High School Proficiency Test (HSPT9), to measure the basic skills achievements of ninth-grade students. The first due-notice administration of the HSPT9 occurred in 1983–84; the first time the test was administered as a graduation requirement was 1985–86.

In 1988, the New Jersey Legislature passed a law which moved the High School Proficiency Test from the ninth grade to the eleventh grade. The Grade 11 High School Proficiency Test (HSPT11) was a rigorous test of essential skills in Reading, Mathematics, and Writing. It served as a graduation requirement for all public school students in New Jersey who entered the ninth grade on or after September 1, 1991. Three years of due-notice testing were conducted to allow school districts time to modify curricula and prepare students for the graduation test.

In 1996, the New Jersey State Board of Education adopted Core Curriculum Content Standards to describe what all students should know and be able to do at the end of fourth grade, eighth grade, and upon completion of a New Jersey public school education. The Core Curriculum Content Standards delineate New Jersey's expectations for student learning. All New Jersey school districts are required to organize instruction and design curricula so that virtually all students achieve the new content standards. The Core Curriculum Content Standards ultimately define the state's high school graduation requirements and its testing program to measure benchmark achievements toward those requirements in grades 4, 8, and 11.

The Elementary School Proficiency Assessment (ESPA), which was administered to fourth- and fifth-graders, was designed from its inception in 1997 to align with the content standards, as is the New Jersey Assessment of Skills and Knowledge (NJASK), which replaced the ESPA. The Grade Eight Proficiency Assessment (GEPA), which replaced the Grade 8 Early Warning Test (EWT) administered to eighth-graders from 1991 to 1996, is additionally aligned with the content standards. The GEPA should be used for placement purposes and program planning for appropriate instruction to enable students to ultimately pass the state's graduation test. The High School Proficiency Assessment (HSPA), which is also aligned with the content standards and has replaced the HSPT11 as the state's graduation test, was field tested for a three-year period. The HSPA was administered to eleventh-graders as a graduation test for the first time in March 2002.

HSPA SCIENCE & OPEN-ENDED QUESTIONS

Science is not merely a collection of facts and theories but a process, a way of thinking about and investigating the world in which we live. The practice of Science requires the use of skills of inquiry in order to carry out the scientific process. The Science section of the High School Proficiency Assessment measures a student's ability to solve problems by applying Science concepts. Assessment items relate to the three Science clusters: Life Science, Physical Science, and Earth Science.

The Science section of the test consists of four parts containing multiple-choice questions and open-ended questions. Each section contains 15 multiple-choice questions and 1 open-ended question for a total of 60 multiple-choice and 4 open-ended questions. It is expected that students will take approximately 1 minute to answer each multiple-choice question and approximately 5 minutes to answer each open-ended question.

The open-ended questions must be responded to in the area provided in the answer folder. Specific directions with each question will refer the student to the page in the answer folder where the response is to be written. For each of these questions, a student must provide enough explanation so that the scorer can understand the solution. Appropriate diagrams, charts, formulas, and/or symbols can be used even when the question does not specifically request their use. The student's response will be scored on the correctness of the method as well as the accuracy of the answer. No credit will be given for anything written in the test booklet. Responses must be in English in order to be scored.

The open-ended questions will be hand scored on a scale from 0 to 3. The generic scoring guide on page 8 was created to help trained readers score open-ended questions consistently. The scoring guide is used by trained readers who score Science open-ended questions on the high school test. Each question on the HSPA has its own item-specific scoring rubric, which is based upon the generic scoring guide.

The students are provided with a Science Reference Sheet as shown on page 6. The reference sheet contains formulas the student may find useful as he/she takes the test. The student is not provided with a calculator.

OPEN-ENDED SCORING FOR SCIENCE

Scoring with the Criteria

All New Jersey high school student open-ended responses for Science are scored by two independent readers each at Measurement Incorporated (MI), the HSPA test contractor.

To accomplish the scoring of the high school open-ended responses for Science, MI selects more than 150 of its most experienced readers, all of whom possess a four-year college degree. All readers, regardless of experience, are required to participate in an intensive three-day training period. Only readers who meet the 80% agreement standard qualify to score New Jersey Science items. By the end of training, the readers have "internalized" the defined criteria at each of the three score points of the rubrics for each item by practice scoring and discussing sample student responses.

Scoring Personnel and Procedures

Current procedures for scoring student open-ended items on the HSPA are consistent with those used by New Jersey since the inception of the statewide assessment. All open-ended items on the HSPA are monitored and scored by trained, experienced personnel. Many individuals are responsible for ensuring the success of scoring any large-scale assessment. Key to the process of scoring New Jersey's high school responses accurately and reliably are MI's senior project manager, the chief reader, team leaders, the readers, and clerical aides.

MI's senior project manager works closely with the department throughout the handscoring process. The senior project manager participates in all rangefinding and training paper selection activities prior to the onset of reader training. The senior project manager directs the activities of the chief reader and oversees all aspects of the project, including monitoring reader performance (reader reliability and production rates), directing retraining efforts, and supervising the capture of scoring data.

The chief reader participates in pre-reading and training paper selection along with MI's senior project manager and the department's Science assessment specialists. Additionally, the chief reader annotates the anchor papers that, along with the scoring criteria, make up the Scoring Guide and trains the team leaders who will subsequently assist in reader training. It is the responsibility of the chief reader to introduce the open-ended items, rubrics, and sample responses; to conduct the majority of the training sessions (some training sets are discussed in teams); and to ensure that readers score reliably and consistently throughout the scoring process. The chief reader supervises the team leaders, directs all scoring and validity procedures, reads and interprets reader quality control reports, and conducts all retraining activities. Additionally, the chief reader assigns all nonscorable codes and does resolution readings.

Each team leader is responsible for small-group training sessions with the eight to ten readers who constitute his/her team. Under the supervision of the chief reader, some training sets are discussed in teams to encourage more questions from individual readers and to allow team leaders to get a clearer picture of the level of understanding of each team member.

Team leaders rely heavily upon periodic individual and small-group retraining to correct reader drift—that is, scoring that is not in accord with the criteria. They spot-check reader scoring packets throughout the project and counsel readers who have a higher than acceptable discrepancy rate. An item is considered discrepant if two independent readers assign non-adjacent scores to the same response (e.g., one reader assigns a "3," the second reader a "1.") Additionally, team leaders meet daily as a group with the chief reader and discuss any scoring differences to guard against team "drift."

Once trained, the readers' primary task is to score accurately all high school Science open-ended items. To accomplish this task, clerical aides distribute scoring packets containing 40 responses and score sheets to each team. The readers, upon taking a packet, record their reader number, team designation, and the date on the scoring packet. The first reader of the packet then codes his/her reader number on the Reader 1 score sheet and proceeds to score all the papers in that packet. Student identification numbers on the score sheet are checked carefully against the numbers on the student response document to make sure that they are in agreement. If there is an error, the packet is flagged (marked with a sticker) for the aide to check. If the aide is unable to correct the error, the packet is given to the chief reader. After all papers in a given packet have been scored once, the aide collects the scored packet, places the first reader score sheet in a bin for scanning, and distributes the packet to a different team for a second reading. The second reader follows the same procedures as the first reader, but uses the Reader 2 score sheet. At no time does the second reader have access to the first reader's scores.

Readers are also responsible for recognizing and flagging nonscorable responses (fragment, off-topic, not English, no response) and "alert" papers (e.g., suspicion of child abuse) so that these papers can be handled in the correct manner. Alert papers are scored, but then forwarded to the chief reader for review. If the chief reader agrees that the student's own words specifically state that a situation qualifies as an alert or reflect a potential risk situation for a child, the paper is copied and sent to the department for documentation and follow-up with district authorities. The Office of Evaluation and Assessment in the Department of Education brings these alerts to the attention of school district personnel. Alert papers are flagged if they reflect potential abuse, emotional or psychological difficulty, or possible plagiarism.

The clerical aides play an important role in maintaining the paper flow throughout the scoring process. They are responsible for keeping enough packets in the scoring room to keep the readers busy. This includes distributing packets for first readings and directing packets that have one reading completed to different teams for second readings. Once packets have been read twice, the aides take them to the warehouse for filing. In addition, the aides collect completed score sheets and forward them to the scanning room, where scores are scanned into the database. If any packets produce resolution readings, the aide retrieves them from the warehouse and gives them to the chief reader for adjudication.

DESCRIPTION OF THIS MANUAL

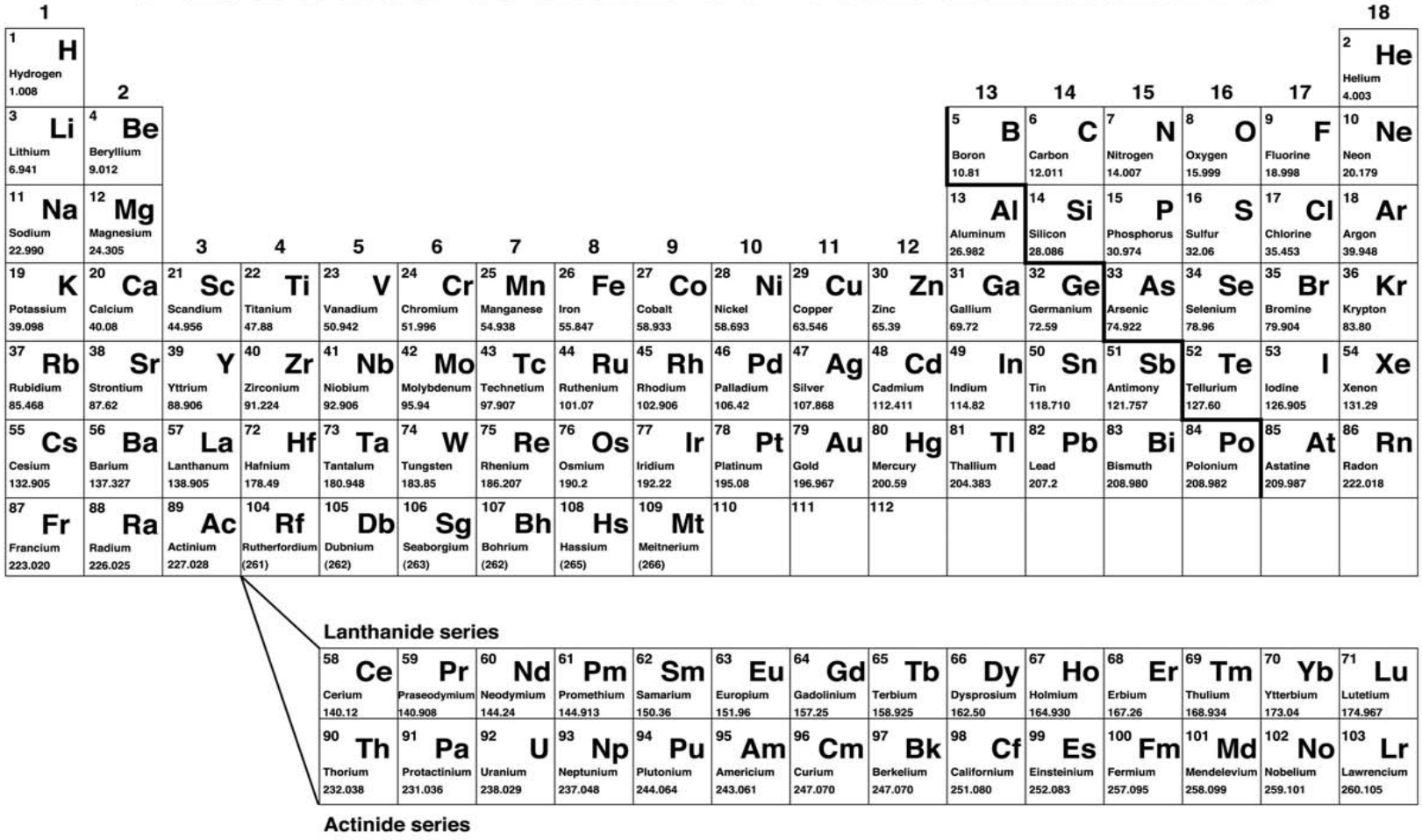
This manual contains six open-ended items, two from each Cluster. The question, sample solution, and item-specific scoring guide are provided for each item. Three exemplar papers for each score point are represented for each of the six open-ended items.

Samples are included for each score point of the Generic Scoring Guide for Science (a 3-point scale, 0 to 3). These sample responses, which are grouped by score point, represent the range of approaches that high school students take with this open-ended item in Science. Each response is annotated according to the score point criteria.

The responses selected to appear in this handbook were written by high school students. The responses appear as the students wrote them; no corrections have been made other than the deletion of specific names that may have appeared to identify the student or the student's school district.

HIGH SCHOOL PROFICIENCY ASSESSMENT
SCIENCE REFERENCE SHEET

PERIODIC TABLE OF THE ELEMENTS



FORMULAS

$$\text{Force} = \frac{Gm_1m_2}{R^2}$$

$$\text{Force} = ma$$

$$\text{Density} = \frac{m}{v}$$

$$\text{Kinetic Energy} = \frac{1}{2}mv^2$$

Scoring Guide for Science Open-Ended (OE) Questions (Generic Rubric)

The zero-to-three-point generic scoring rubric below was created to help readers score open-ended responses consistently. In scoring, a reader should accept the use of appropriate labeled diagrams, charts, formulas, and/or symbols that are part of the correct answer even when the question does not specifically request their use.

3-Point Response

The student response is reasonably correct, clear, and satisfactory.

2-Point Response

The student response has minor omissions and/or some incorrect or irrelevant information.

1-Point Response

The student response includes some correct information, but most information included in the response is either incorrect or irrelevant.

0-Point Response

The student attempts the task, but the response is incorrect, irrelevant, or inappropriate.

The above generic rubric is used as a guide to develop specific scoring guides or rubrics for each of the open-ended (OE) questions that appear on the New Jersey statewide assessments in Science. These scoring rubrics provide the criteria for evaluating and scoring student performance and are developed by a committee of scientists and teachers. Rubrics ensure that there is consistency, fairness, and accuracy in scoring open-ended questions.

Life Science Cluster/Reproduction and Heredity

Directory of Science Test Specifications: 5.5, p. 6, C, 3, B, 2

Genetic engineering has permitted the introduction of deliberate mutations, which may be maintained as new varieties.

In the process of genetic engineering, scientists can develop organisms with traits they would not otherwise possess.

- Identify two biological materials scientists work with when conducting genetic engineering experiments.

- Identify two kinds of cells biologists work with in order to genetically engineer organisms. Explain your answer.

Sample Response:

- Bacterial plasmids, donor DNA, recombinant DNA, gametes, stem cells, restriction enzymes, pasting enzymes, electrophoresis gels

- Human cells, bacterial cells, and yeast cells are typically the kinds of cells biologists use to genetically engineer organisms. Human cells may serve as a source of donor DNA. Bacteria and yeast are specifically used as recipient cells because they are easy to grow in the lab, are small in size, and have a short generation time.

  In essence, DNA from a donor cell is inserted into the genome of a recipient cell. The transformed recipient cell can now be used to reproduce and then synthesize the transformed genetic information.

  Note: Students were given credit for referring to or discussing stem cell research and cloning as an allied branch of genetic engineering and for using the terms *biological tools* and *materials* synonymously.

Scoring Rubric

3-Point Response (5 quality points)

The student successfully completes the task by

- identifying two biological materials used in genetic engineering experiments

AND

- identifying two types of cells that are used in genetic engineering

AND

- explaining why these types of cells are used.

2-Point Response (3-4 quality points)

The student adequately completes the task by

- identifying two biological materials and two types of cells used in genetic engineering experiments

OR

- identifying two biological materials and one type of cell used in genetic engineering experiments

AND

- explaining why this type of cell is used

OR

- identifying two biological materials and one type of cell used in genetic engineering experiments

OR

- identifying one biological material and one type of cell used in genetic engineering experiments

AND

- explaining why this type of cell is used

OR

- identifying two types of cells used in genetic engineering experiments and explaining why these types of cells are used.

1-Point Response (2 quality points)

The student partially completes the task by

- identifying two biological materials used in genetic engineering experiments

OR

- identifying two types of cells used in genetic engineering experiments

OR

- identifying one biological material and identifying one type of cell used in genetic engineering experiments

OR

- identifying one type of cell used in genetic engineering experiments and explaining why this type of cell is used.

0-Point Response (0-1 quality points)

The student attempts the task, but the response is incorrect, incomplete, or inaccurate.

Note: A paper that identifies only one biological material or type of cell used in genetic engineering experiments receives 0 score points.

Student scores were derived by assigning one quality point for each correct response.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16. In the process of genetic engineering, Scientists can develop organisms with traits they would otherwise not posseSS. Two biological materials Scientists work with when conducting genetic experiments are DNA and RNA; both substances found in all living organisms are in fact the basic building blocks of life. If any part of a chemical DNA strand is manipulated, the cell will act according to the instructions imprinted on the DNA strand and if manipulated by scientists the strand will characterize what the various traits will be of the organism. Any and every cell can be used and manipulated by scientists to genetically engineer it to behave differently, or in any way. For example, scientists added a gene found in fireflies, that cause them to glow and produce a mating ritual, and added it to the DNA sequence of an ordinary Tobacco plant, thus forming the glow-in-the-dark tobacco plant and genetically altering the typical plant. This proves that any living organism may be genetically engineered or altered by scientists.

Score Point: 3
This student correctly identifies DNA and RNA as the materials used in genetic engineering experiments. A detailed explanation of why "any" and "every" cell can be used to produce a transgenic organism has been successfully provided.

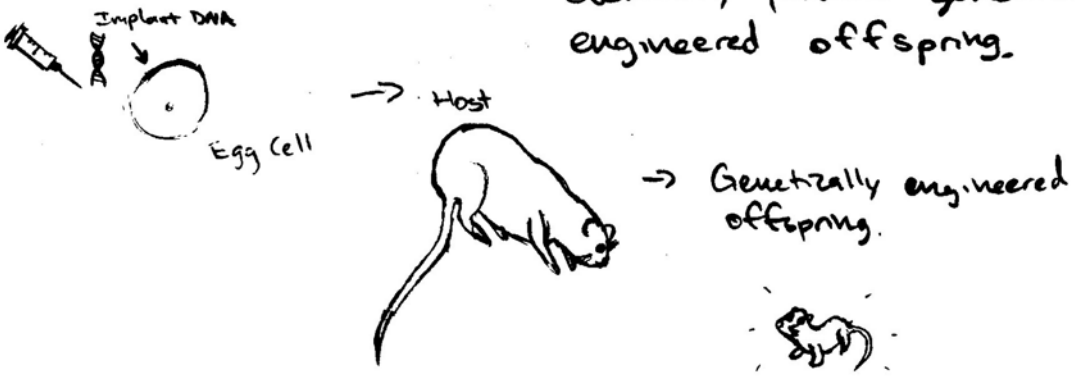
SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

- Scientists must work with the DNA of the specimen to alter the genetic code. Also, they need a host to implant that changed section of DNA. This would be an egg cell for animals.

- Scientists must work with egg cells to perform genetic engineering. A new section of genetic code must replace a previous section. The egg cell is then transplanted into a host where the host will eventually produce genetically engineered offspring.



Score Point: 3
This student correctly identifies DNA and egg cells as the biological materials used in genetic engineering experiments. A detailed explanation, including a graphic, explains "why" and "how" each may be used.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

Scientists most likely have to work with biological materials like DNA or RNA in reproductive cells like sperm, eggs, or seeds.

Biologists have to work with DNA because that is the only way for the genetic traits that they engineered to be passed down.

Score Point: 3
This student correctly identifies the "DNA and RNA in reproductive cells" as two biological materials used in genetic engineering experiments. The student correctly states that "biologists have to work with DNA because that is the only way for genetic traits that they engineered to be passed down."

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16. Two biological materials scientists work with are cells and amino acids. All organisms are composed of cells and the "building blocks" of life are amino acids, which chain together to form proteins. Sonds order to conduct genetic experiments in hopes of creating new organisms, scientists must work with cells and amino acids.

Scientists must work with sex cells in order to genetically engineer organisms. Sex cells carry the necessary biological materials that initiate life: Genetic materials such as Chromosomes and DNA, and of course, amino acids. If scientists wish to engineer traits, they would have to experiment on the chromosomes and DNA which carry the trait codings in the form of amino acids. In order for these new traits to spread, they would have to be in the sex cells for reproduction.

Score Point: 2
This student is given credit for identifying "cells" as a biological material used in genetic engineering experiments. Sex cells are identified as the type of cells that could be used because "in order for these new traits to spread, they would have to be in the sex cells for reproduction."

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

Two bidogical materials that scientists work with when conducting genetic experiments are DNA and cells.

Biologists must work with stem cells because they contain most of the DNA required to create a copy of the organism that they come from.

Score Point: 2
This student correctly identifies "DNA" and "cells" as two biological materials used in genetic engineering experiments and then identifies a stem cell as the kind of cell used. No credit is given for the explanation of why stem cells may be used.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

TWO BIOLOGICAL MATERIALS SCIENTISTS WORK WITH WHEN CONDUCTING GENETIC EXPERIMENTS ARE DNA and RNA.

BIOLOGISTS MUST WORK WITH SEX CELLS

Score Point: 2
This student correctly identifies DNA and RNA as two biological materials used in genetic engineering experiments and cites "sex cells," without an explanation, as the kind of cells used in these experiments.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16. One biological material that scientists work with when conducting genetic experiments is cells Scientist obviously must also use chromosomes, because they carry the genes. These two are the leading sources when conducting genetic experiments.

The kind of cells that biologists must work with in order to genetically engineer organisms is blood cells. This is because they flow through the bloodstream and will therefore carry them to the organisms.

Score Point: 1
This student is given credit for bullet #1 by identifying "cells" and "chromosomes" as two biological materials that can be used in genetic engineering experiments.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

Two biological materials scientists work with are:-

→ cells of the species being genetically engineered

→ organic solution to preserve it.

Scientists must work with gamets

Score Point: 1
This student is given credit for identifying "cells of a species" as a biological material and for identifying "gamets" as the cell type used in genetic engineering experiments.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

① Sperm Cell

② Egg Cell

Score Point: 1
This student is given credit for identifying a "sperm cell" and an "egg cell" as biological materials used in genetic engineering experiments.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

Two biological materials scientist work with conducting genetic experience is a microscope and the glass dish

The kind of cells biologists must work with are cell membrane, cell nucleus. That helps with genetics to find out if cells matchup.

Score Point: 0
This student incorrectly identifies two physical tools, "a microscope" and "the glass dish," as tools used in genetic engineering experiments. Stating that "the kinds of cells biologists must work with are cell membrane, cell nucleus" is incorrect.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16. In order to develope organisms with traits that they would not otherwise posses, They would have to alter their DNA code. The DNA code contains all the information about that organism including genes. In order to do this animal cells must be used. The reason for this is because this allows them to reproduce according to their genes.

Score Point: 0
A paper that identifies only one biological material receives a score of "0." The references to animal cells and the explanation for bullet #2 are incorrect.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16. The need microscopes so they can at least see the cells. And they would all so need some safety goggles for their eyes.

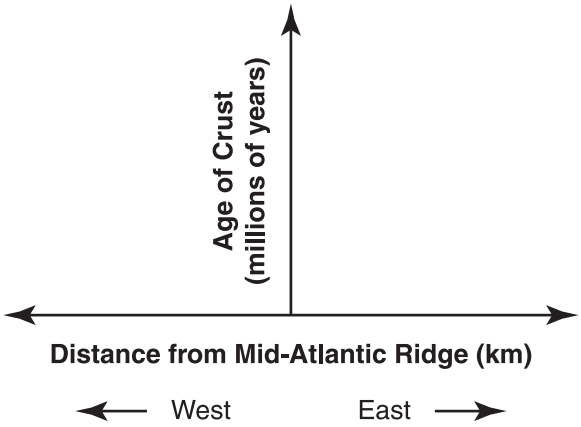
The kind of cells they must work with are animal or plant cells.

Score Point: 0
This student incorrectly identifies two non-specific physical tools, "microscopes" and "safety goggles," as tools used by a genetic engineer. Bullet #2 lacks any explanation of why plant and animal cells are used.

Earth Science Cluster/Structure and Dynamics of Geophysical Systems

Directory of Science Test Specifications: 5.9, p. 12, A, 4, D

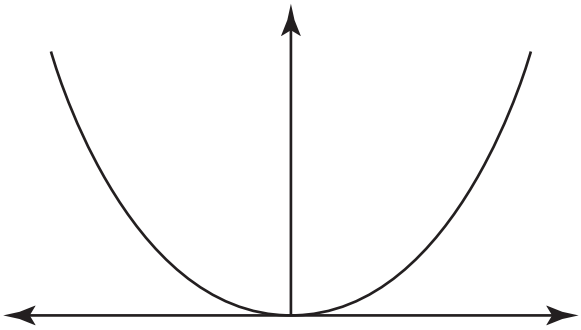
The *Theory of Plate Tectonics* can be used to explain earthquakes, volcanoes, mid-ocean ridges, and deep sea trenches.



A set of axes for mapping the relationship between the age of oceanic crust and the distance from the Mid-Atlantic Ridge is shown above.

- In your answer folder, draw a graph showing the expected trends between distance and age.
- Use the theory of plate tectonics to explain your answer.

Sample Response:

- 

- According to the theory of plate tectonics, new crust is formed at mid-ocean ridges. This pushes older crust from the ridge. As the plates move apart from each other, magma from beneath Earth's surface rises up, fills in the gaps, and hardens into crust. New crust is continually being formed in this manner. Thus, the greater the distance from the mid-ocean ridge, the older the crust.

  Note: The graph could be either two straight lines bent upward or two curved lines bent upward.

Scoring Rubric

3-Point Response

The student successfully completes the task by

- drawing a graph that shows increased age as the distance from the ridge increases

AND

- using the theory of plate tectonics to explain why this is so.

2-Point Response

The student adequately completes the task by

- drawing a partially correct graph (e.g. mixing the *x*- and *y*-axes; getting the east quadrant correct, but not the west)

AND

- accurately using plate tectonics to explain why the age of the crust increases as the distance from the ridge increases

OR

- drawing a correct graph

AND

- giving a partial explanation of why the age of the crust increases as the distance from the ridge increases.

1-Point Response

The student partially completes the task by

- drawing a partially correct graph

AND

- partially explaining why the age of the crust increases as the distance from the ridge increases

OR

- drawing a correct graph with no accompanying explanation

OR

- explaining why the age of the crust increases as the distance from the ridge increases, with an incorrect or partially correct graph.

0-Point Response

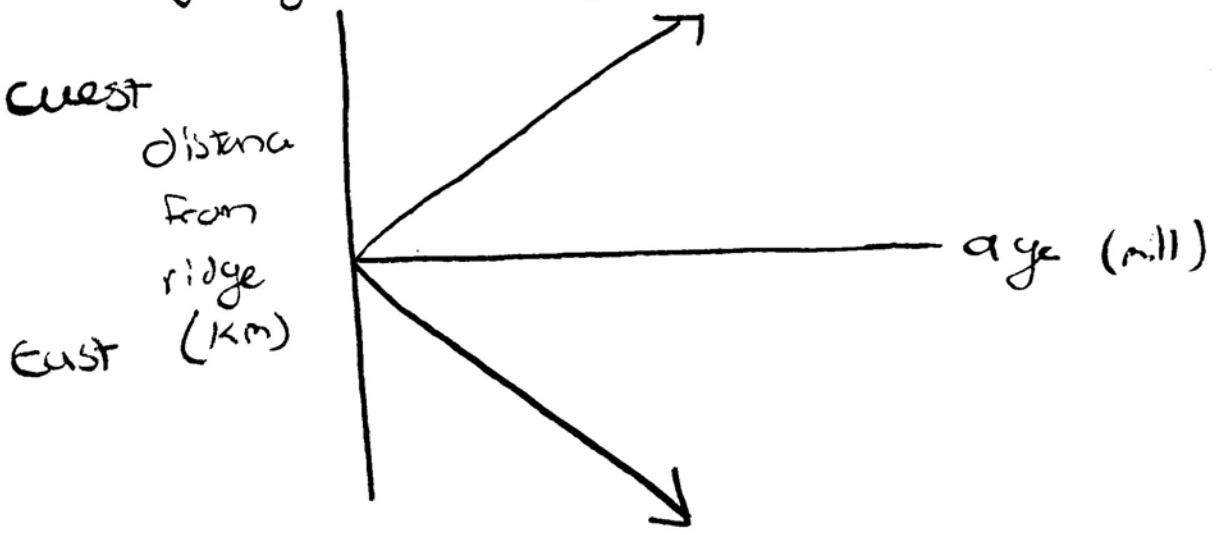
The student attempts the task, but the response is incorrect, incomplete, or inaccurate.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

Tectonic plates move on the surface of the earth. the mid-atlantic Ridge is in the middle of the atlantic, and it is a Ridge where 2 tectonic plates are constantly separating. Crust forms on the ridge, but after the years it moves further away from it, with the plates. the closer to the ridge, the younger the crust.



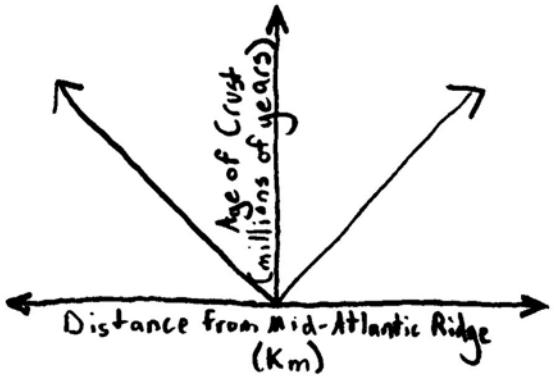
Score Point: 3

This student correctly draws a graph showing the increased age of the oceanic crust with an increased distance from the Mid-Atlantic Ridge. An explanation of the process is also successfully provided.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



This graph is only accurate until other tectonic plates are reached

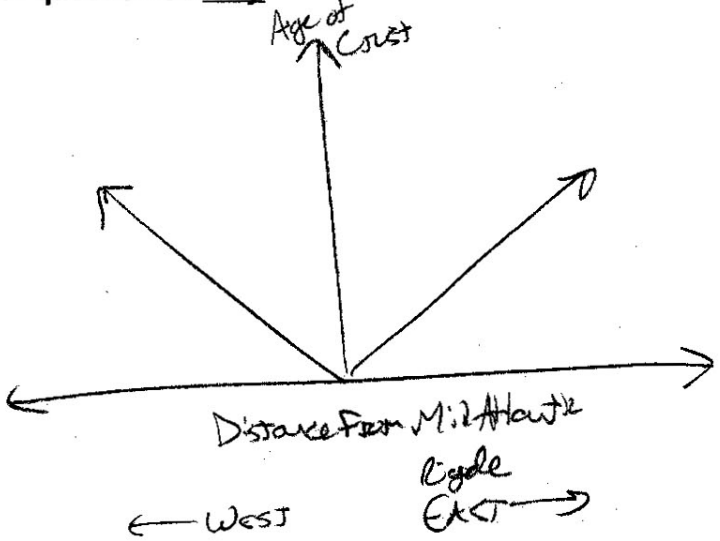
At the Mid-Atlantic Ridge, magma from the Earth's mantle rises and cools to form new crust. The new crust pushes the old crust apart, shifting the tectonic plates away from each other. This way, new crust is continually being created 0Km from the Ridge, and existing crust is being pushed away while it gets older.

Score Point: 3
This student has correctly drawn a graph showing the increased age of the oceanic crust with an increased distance from the Mid-Atlantic Ridge. An explanation for the process has also been successfully provided.

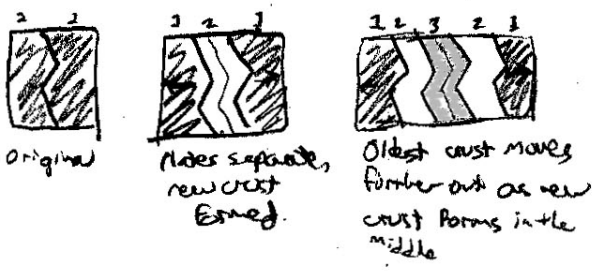
SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



As the plates separate, rising magma fills the gap between them and becomes new crust. As they continue to separate over a period of millions of years, the oldest crust will move further out as new sections of crust are formed.

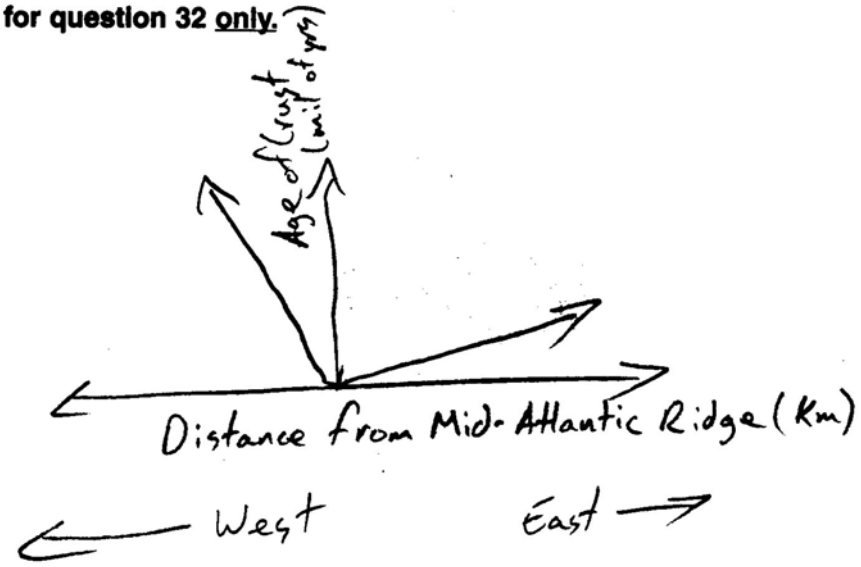


Score Point: 3
This student has correctly drawn a graph showing the increased age of the oceanic crust with an increased distance from the Mid-Atlantic Ridge. An explanation for the process has also been successfully provided.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



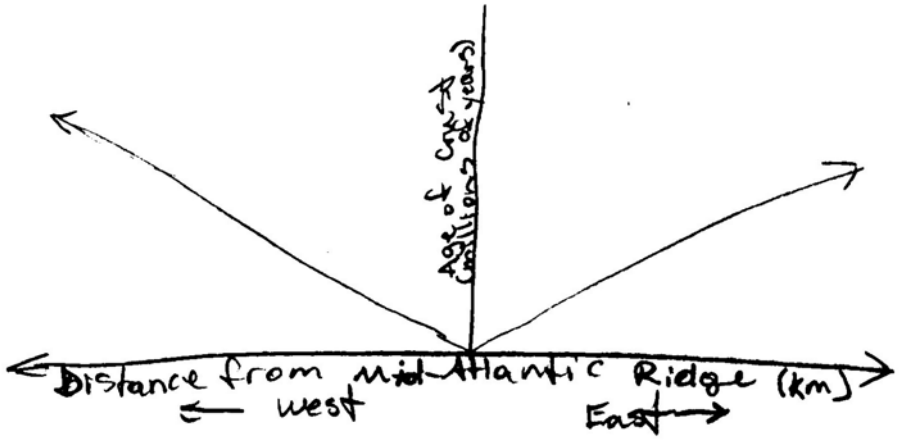
The crust to the East of the Mid Atlantic Ridge would be younger than the crust to the West because the Western crust would slowly be moving away from the Eastern crust. This would make the crust that is further away older than the crust that is closer.

Score Point: 2
This student has a partially correct graph. The explanation for the increasing age of the oceanic crust contains inaccurate information.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



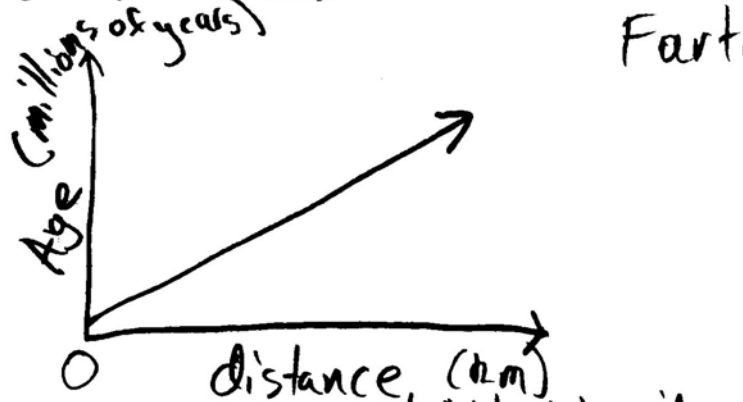
The farther away from the Mid Atlantic Ridge, the older it is. This is because new crust is being formed at the Mid-Atlantic Ridge while the old crust is being pushed away from it. The arrows on my graph show this.

Score Point: 2
This student correctly draws a graph showing the age of the oceanic crust increasing as the distance from the ridge increases. Partial credit is given for an incomplete explanation of the process.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



Farther away = older

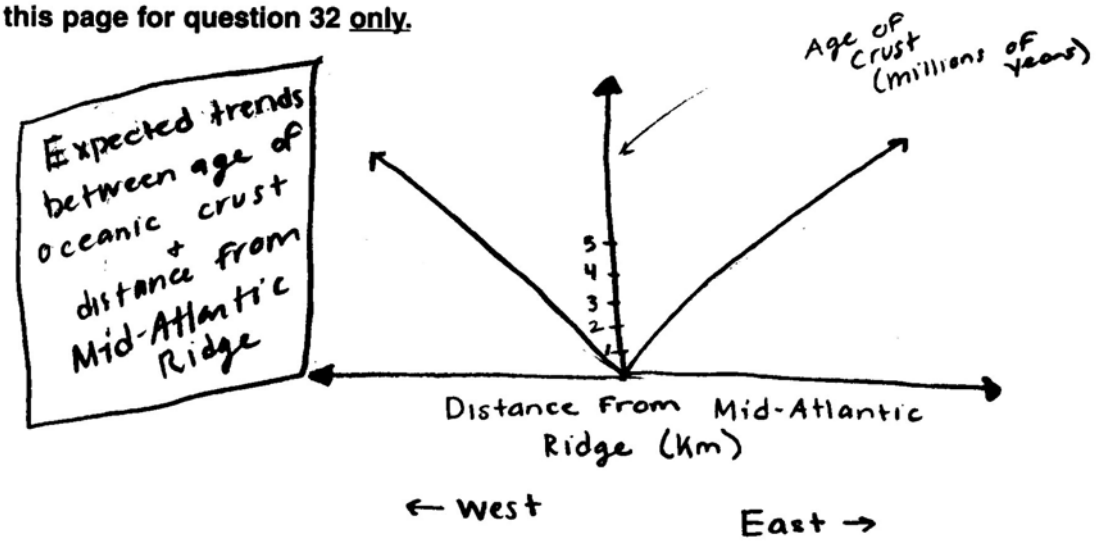
The Mid-Atlantic ridge is formed by two plates moving apart. This movement creates a long crack in the Earth's surface through which magma emerges. The magma hardens to create the "crust." As the plates continue to move away from each other more magma emerges from ~~the~~ crack of pushes the older layer of crust ~~down~~ down & away from the split. Thus the more new magma emerges the farther the old crust is pushed away from the Ridge.

Score Point: 2
This student has drawn only half of the graph but has successfully explained that "as plates continue to move away from each other more magma emerges from the crack of pushes the older layer of crust down & away from the split."

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



Theory of plate tectonics → plates are constantly in motion

The graph shows that the older a plate tectonic is then the further away from the Mid-Atlantic Ridge it will be located. This is because the plate is in constant motion and thus continues to move away from the Mid-Atlantic Ridge throughout its "life".

Score Point: 1
This student has correctly drawn the graph showing the relationship between age of the oceanic crust and distance from the mid-ocean ridge but has not explained the role of plate tectonics on the process.

SCIENCE
OPEN-ENDED RESPONSE

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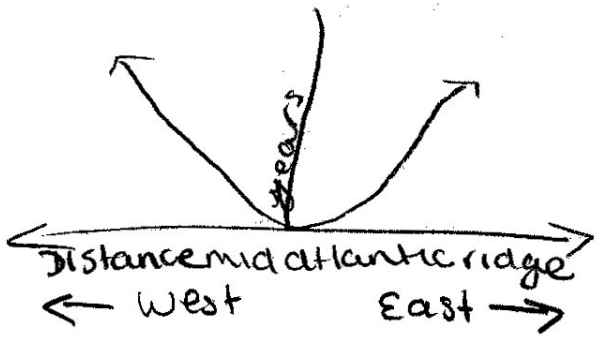
32.



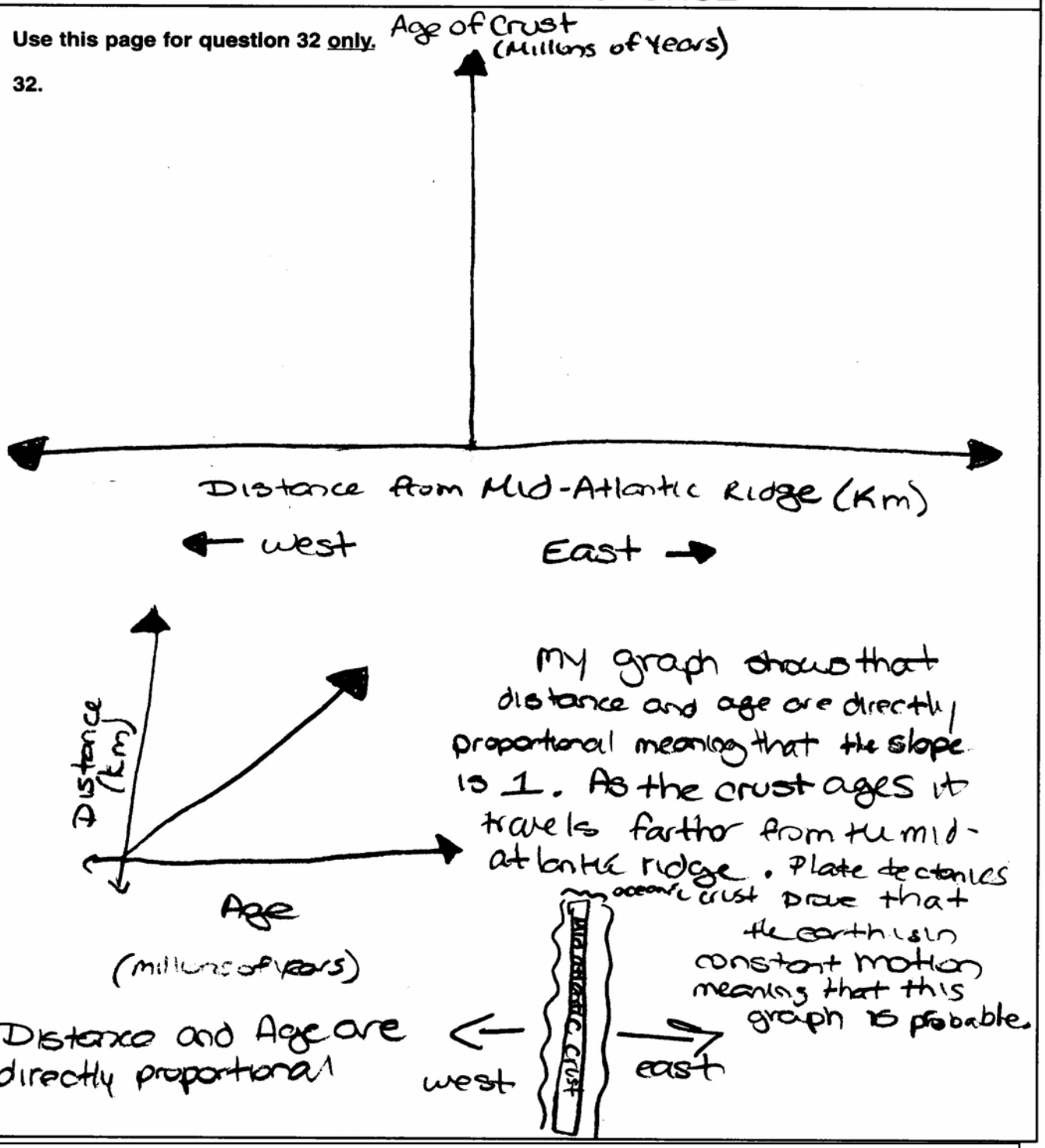
Each year the distance will increase little by little away from the mid atlantic ridge

Score Point: 1
This student has correctly drawn the graph but has not provided a correct explanation of why the age of the oceanic crust is increasing.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



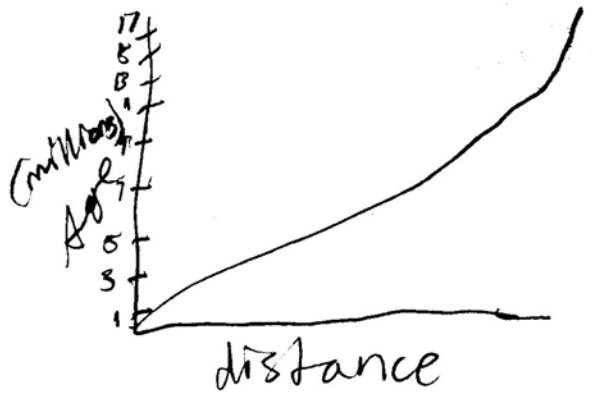
Score Point: 1

This student has partially completed the task by supplying only one half of the graph and an incomplete explanation of why the oceanic crust is older the farther it gets from the mid-ocean ridge.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



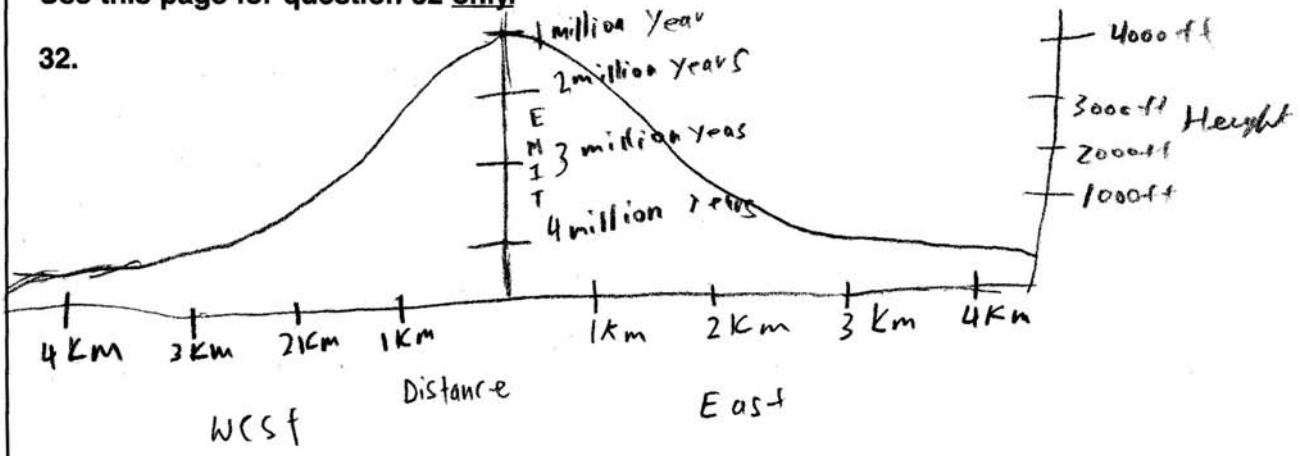
As the years pass, the distance increases. Plate tectonics are always moving and always moving further apart as years go by.

Score Point: 0
This student's response only shows one half of the graph. According to the theory of plate tectonics, the oceanic crust increases in age to both the east and west of the mid-ocean ridge. The response also lacks an accurate explanation of the process.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



As the age of the crust increases the height of the ridge should decrease. The younger the ridge is, the higher the elevation. If the ridge is younger then the distance from the ridge both east and west should also be longer. Younger = higher elevation of the ridge, and older means lower elevation. Younger equals more distance, while older equals less distance.

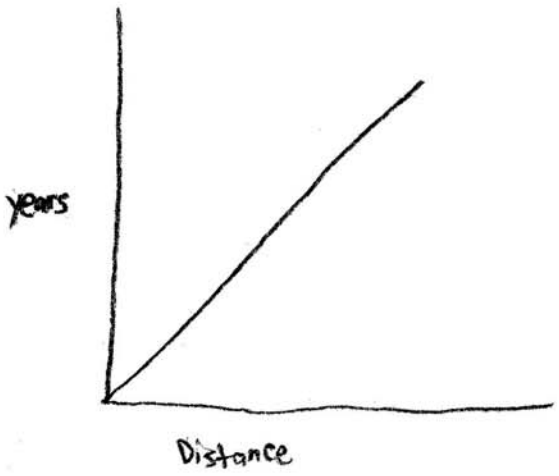
Score Point: 0

This student's response is incorrect. The graph has been drawn incorrectly, and the student's explanation focuses on the height of the ridge rather than the age of the oceanic crust.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



The plates have been moving away from the Mid-Atlantic Ridge over time. The plates were originally all next to each other, and the continents were one large land area. Over millions of years, the land broke apart into seven pieces because the plates began to move away from the Mid-Atlantic Ridge. The plates continued to move fartherand farther away from the Ridge for millions of years.

Score Point: 0
This student's response only shows one half of the graph. According to the theory of plate tectonics, the oceanic crust increases in age to both the east and west of the mid-ocean ridge. The response also lacks an accurate explanation of the process.

Physical Science Cluster/Chemistry/Matter

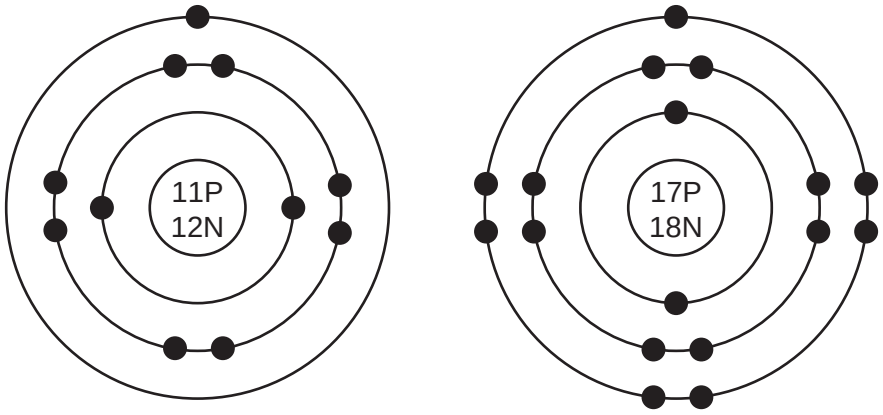
Directory of Science Test Specifications: 5.6, p. 7, A, 3

Atoms may transfer electrons to another atom or atoms and may share electrons equally or unequally between them.

Sodium is a metal found in Group 1 of the periodic table, and chlorine is a non-metal found in Group 17.

- Draw a diagram of each element. Include the proper number of subatomic particles present in each atom.
- When sodium reacts with chlorine, sodium chloride is formed. Use the atomic diagrams you have drawn to explain how electrons are transferred from one atom to the other.
- Identify the particles and charges produced as a result of the electron transfer.

Sample Response:

- 

Sodium Chlorine

- Sodium's single valence electron is transferred to the chlorine atom. The Na then becomes a positively charged Na^{+1} ion, because it still has 11 protons and now only 10 electrons. The chlorine atom now has an extra electron, for a total of 18, but it still only has 17 protons. As a result, the chlorine atom becomes a negatively charged chloride ion (Cl^{-1}).
- The new particles are called "ions." Since sodium is the electron donator, it takes on a (+) charge, and because the chlorine is the electron acceptor, it takes on a (–) charge.

Scoring Rubric

3-Point Response

The student successfully completes the task by

- drawing an accurate diagram of both atoms with the appropriate number of subatomic particles

AND

- explaining the transfer of electrons in terms of his or her diagram and the octet rule

AND

- correctly identifying the particles and charges produced.

2-Point Response

The student adequately completes the task by

- drawing a completely or mostly accurate diagram of both atoms

AND

- completely or partially explaining the transfer of electrons

AND

- identifying the particles and charges produced.

The response has one or more minor inaccuracies or omissions.

1-Point Response

The student partially completes the task by

- drawing an accurate diagram of both atoms with appropriate numbers of subatomic particles

OR

- partially explaining the transfer of electrons and identifying the particles or charges produced

OR

- drawing a mostly accurate diagram of both atoms

AND

- partially explaining the transfer of electrons

OR

- identifying the particles and charges produced.

0-Point Response

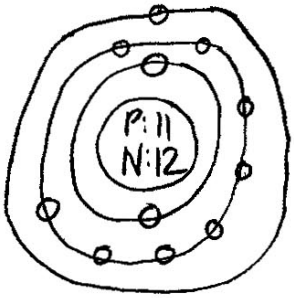
The student attempts the task, but the response is incorrect, incomplete, or inaccurate.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

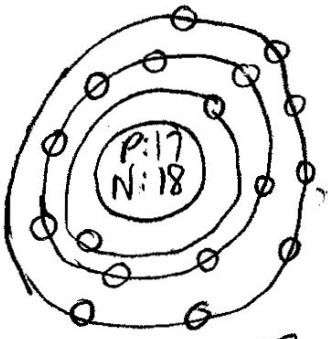
Sodium atom:



(Na)

11 protons 11 electrons
12 neutrons

Chlorine atom:



(Cl)

17 protons 17 electrons
18 neutrons

$Na^{\odot} + \cdot\dot{\underset{\cdot\cdot}{Cl}}: \longrightarrow Na^{\odot} + :\dot{\underset{\cdot\cdot}{Cl}}: \longrightarrow [Na]^{+} - [Cl]^{-}$

1 e^- in outer shell

7 e^- in outer shell

1 e^- from Na is transferred to Cl atom, completing an octet

NaCl formed:
Na: ⊕ ion
Cl: ⊖ ion
bonded together to make an NaCl molecule.

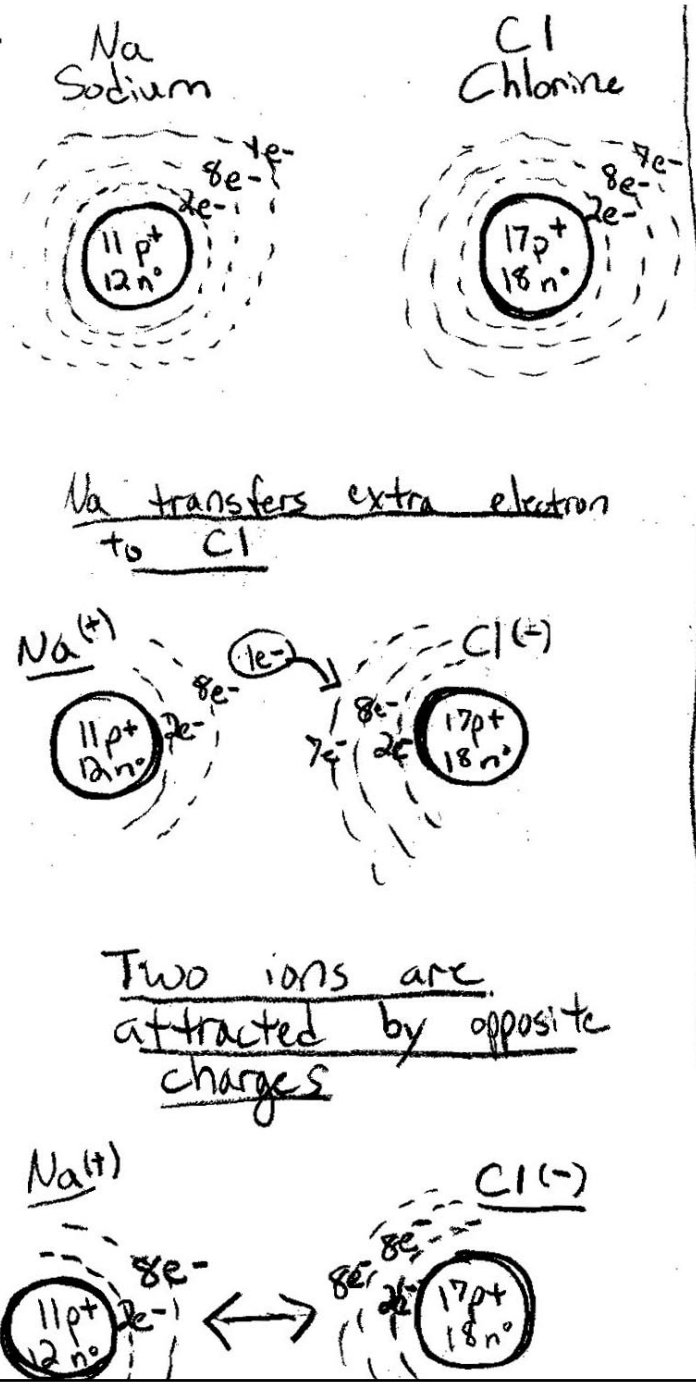
Particles produced are an Na^+ ion and a Cl^- ion. The Na^+ ion is present because Na lost an electron during the transfer, so its charge is now positive. The Cl^- ion is present because Cl gained an electron during the transfer, so its charge is now negative. The attraction between the Cl^- ion and the Na^+ ion cause an ionic bond to form between them to make an NaCl molecule.

Score Point: 3
This student has successfully completed the task by drawing an accurate diagram with the appropriate numbers of subatomic particles, explaining the transfer of electrons and the octet rule, and correctly identifying the particles formed in the bond and the charges produced.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



Both sodium and chlorine are very reactive elements because their atoms long to have an octect of electrons on the outer shell. Each one is only 1 electron away from obtaining an octect.

When the two atoms meet, sodium gives up one electron to chlorine, resulting in two ions that have full outer shells. Sodium becomes a positive ion, Chlorine becomes negative. The two are attracted to each other and form Sodium chloride, or table salt.

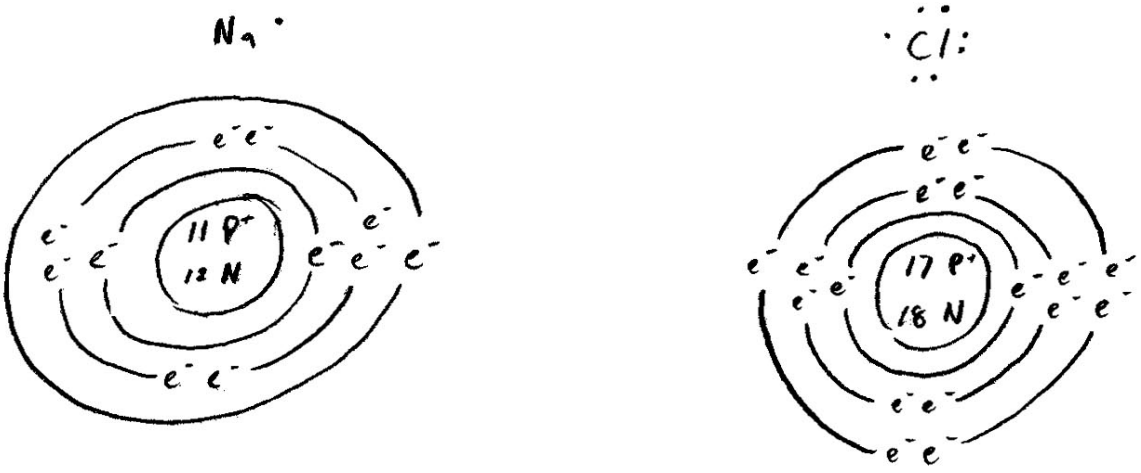
Score Point: 3

This student has successfully completed the task by drawing an accurate diagram with the appropriate numbers of subatomic particles, explaining the transfer of electrons and the octet rule, and correctly identifying the particles formed in the bond and the charges produced.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



NaCl is a molecule that is held by an ionic bond. The outer electron in Na transfers itself to the outer orbital of Cl atom in order to completely fill Chlorine's outer orbital. Sodium's lost electron causes it to become a positively charged ion while the extra electron chlorine recieved caused it to become negatively charged. The difference in charge allows them to ionically bond.

1) $Na\cdot \rightarrow \cdot\ddot{Cl}:$

2) $Na^+ \; :\ddot{Cl}^-:$

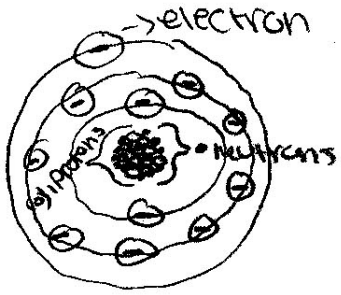
3) $Na:\ddot{Cl}:$

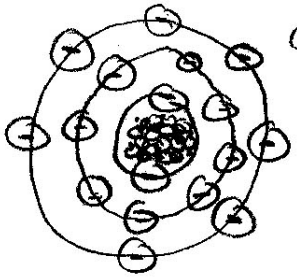
Score Point: 3
This student successfully completes the task by drawing an accurate diagram with the appropriate numbers of subatomic particles, explaining the transfer of electrons, and correctly identifying the particles formed in the bond and the charges produced.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.





○ = 17 protons
⊖ = 17 electrons
• = neutrons

Na

Cl

The one valence electron from Na is donated to Cl. Both atoms are happy because they each have eight valence electrons. The two atoms are attracted because Na is positively charged because it lost an electron and Cl is negatively charged because it gained an electron. NaCl is a neutral molecule because the positive Na cancels out the negative Cl ($Na^+ + Cl^- \rightarrow NaCl$).

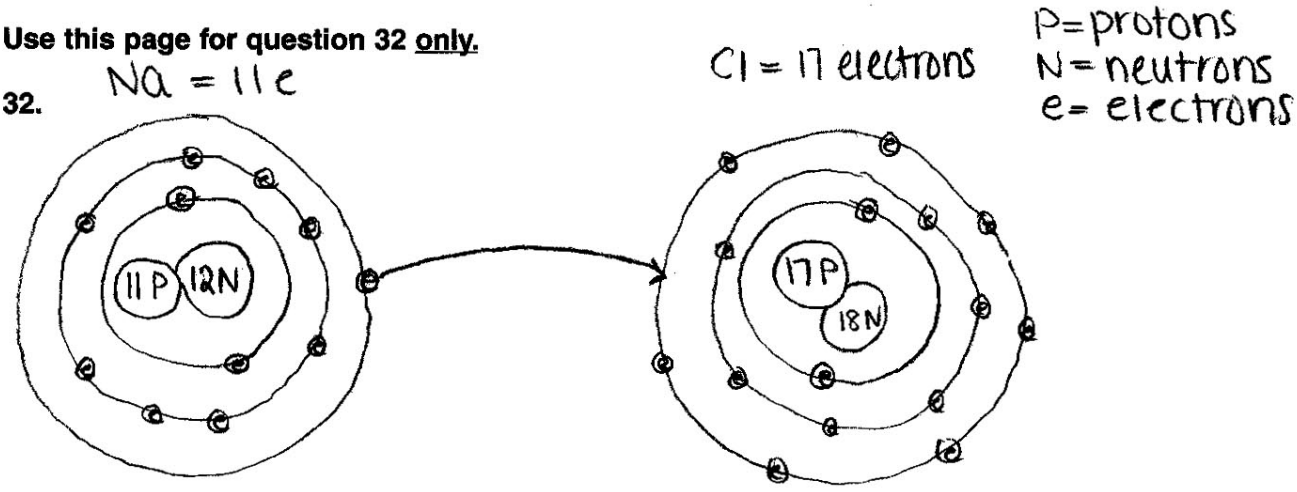
Score Point: 2

This student completes the atomic drawings, although it is difficult to determine the correct number of protons and neutrons in the sodium atom and the number of neutrons in the chlorine atom. The statement "The one valence electron from Na was donated to Cl" suggests the student does not fully understand how an ionic bond is formed.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



Since Chlorine is more stable because it has 7 valance electrons, it would be harder for chlorine to give up all 7 electrons. Instead Sodium, which only has 1 valance electron, will transfer its 1 electron to chlorine's outer shell. Now chlorine has a full outer shell. Sodium has a 1^+ charge & chlorine has a 1- charge, their charges cancell out. Sodium now has 10 electrons and chlorine has 18.

Score Point: 2
This student draws a complete diagram that identifies the correct number of subatomic particles in each atom. A partially complete explanation of the diagram is supplied, but the student fails to identify the particles formed as ions and a reason why each particle now possesses a charge.

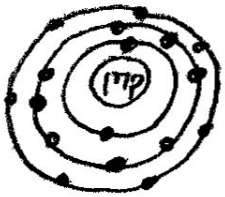
SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

key- p - protons
• - electrons

32. Na - Sodium

Cl - chlorine



each element wants to have an octet (8 electrons in their outer shell). since sodium (IVa) is a metal it has one in it's outer shell. chlorine (Cl) has seven. In group 1 when bonded sodium gives up that one electron to chlorine so that now both have 8 electrons because the next shell for sodium has 8 which makes them stable and form NaCl (sodium chloride).

NaCl (sodium chloride) is the result of the bonding and the charge is neutral because each charge of the element cancles out.

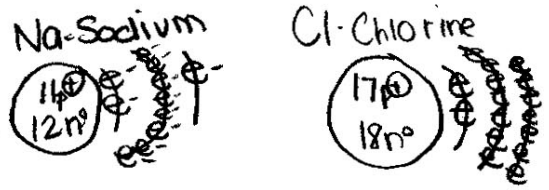
$Na^{+1} + Cl^{-1} = NaCl$

Score Point: 2
This student's diagram is not complete since it fails to identify the correct number of neutrons in both the sodium and chlorine atoms. The atomic diagrams are correctly used to explain the bond formed, but the student fails to identify the particles formed as ions.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



- Since Cl is one electron shy of having a full outer electron shell, Na (Sodium) shares its single electron in the outer shell with Cl's outer 7 electrons. Now when Na+Cl combine they have a full 8 electrons in the outer shell.
- NaCl now has 28 electrons, 28 protons, 30 neutrons and an atomic mass of 58.

Score Point: 1

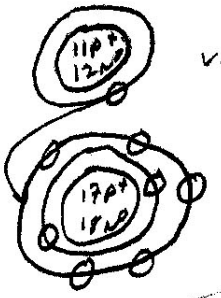
This student satisfactorily draws the atomic diagrams for both sodium and chlorine. It appears that the student uses the diagrams to explain covalent bonding rather than ionic bonding. For this reason, there is a failure to identify the particles formed and their charges.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

P+ = PROTONS
N⁰ = NUTRONS
e⁻ = ELECTRONS



VALENCE ELECTRONS SHOWED

ELECTRON MOVES TO CHLORINE SO BOTH BECOME/ACT LIKE THE NEAREST NOBLE GAS.

	CHARGE BEFORE TRANSFER	CHARGE AFTER TRANSFER
SODIUM (Na) –	0	-1
CHLORINE (Cl) –	0	+1

Score Point: 1
This student's diagram correctly supplies the number of protons and neutrons in each nucleus but fails to give the correct number of electrons in each energy level. There is a partial attempt to explain the transfer of electrons, but the particles produced as a result of the transfer are not identified.

SCIENCE
OPEN-ENDED RESPONSE

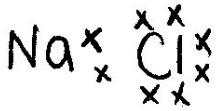
Use this page for question 32 only.

32.

A.

1 electron outter 7 electrons

B.



Na gives one to make both stable

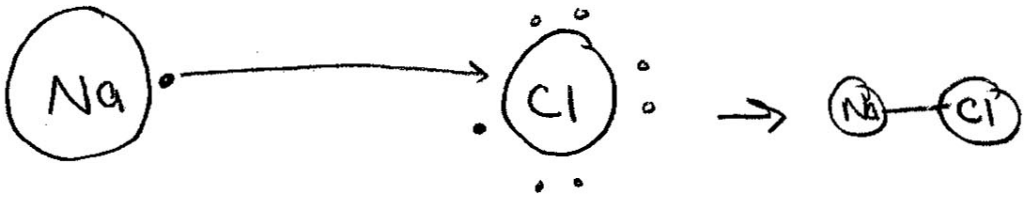
C Sodium become positive because gives up one and chlorine becomes negative because it gains one.

Score Point: 1
This student receives credit for a partial description of the transfer of electrons and for identifying the charges produced. The atomic diagrams and their explanations are incomplete.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



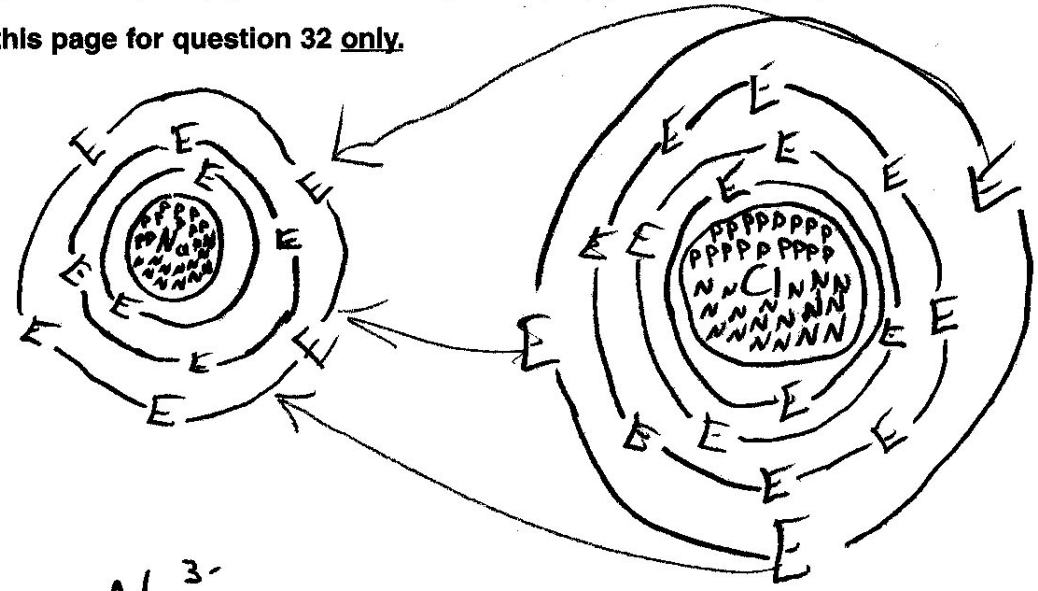
the electron from the positively charged sodium atom is transferred to the negatively charged chlorine atom to form an octet.

Score Point: 0
This student incorrectly draws the atomic diagrams, fails to indicate the correct number of subatomic particles and the number of electrons in each energy level, and fails to identify the particles that are produced, along with their charges.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



added 3 electrons

lost 3 electrons

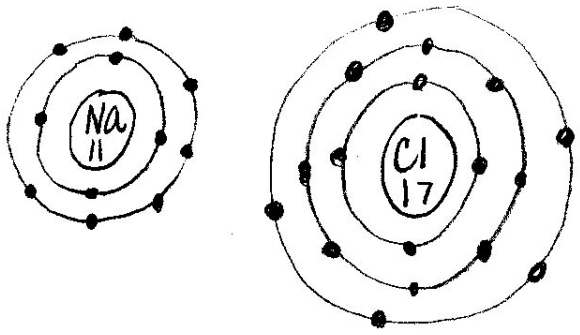
Score Point: 0

This student attempts the task of drawing the atomic diagrams, but the response is incorrect. The energy levels do not contain the correct number of electrons. The student also fails to explain the transfer of electrons and does not identify the particles and charges produced.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



Score Point: 0

This student attempts the task of drawing the atomic diagrams, but the response is both incorrect and incomplete. The diagram is missing the neutron number inside the nucleus, and the energy levels do not contain the correct number of electrons. The student fails to explain the transfer of electrons and does not identify the particles and charges produced.

Life Science Cluster/Energy/Organization of Living Things

Directory of Science Test Specifications: 5.5, p. 5, A, 4

Plants and those organisms containing chloroplasts use solar energy to combine molecules of carbon dioxide and water into complex, energy-rich organic compounds and release oxygen into the environment.

A student wants to measure the influence of chloroplast activity in plants.

- Design an experiment the student could perform using 10 potted plants.
- Identify two controls and two variables the student could observe.

Sample Response:

- Procedure:
  Plant ten plants in ten pots using an identical kind of soil.
  Grow five of the plants in an area exposed to sunlight.
  Grow five of the plants in a dark room.
  Water all plants equally.
  All factors should be the same, so the experiment is controlled.
  Compare the growth of both sets of plants after two weeks.

  Variables: Exposure of the plants to light and the growth of the plants

  Controls: Watering plants equally, planting in the same type of pot, using identical soil, receiving equal amounts of nutrients

Scoring Rubric

3-Point Response

The student demonstrates clear understanding of the task by

- providing a relevant and plausible experimental design

AND

- identifying two controls and two variables.

2-Point Response

The student demonstrates an adequate understanding of the task by

- providing a relevant and plausible experimental design

AND

- identifying two controls

OR

- providing a partial experimental design

AND

- identifying two controls and two variables.

1-Point Response

The student demonstrates partial understanding of the task by

- providing a partial experimental design

OR

- identifying two controls and two variables.

0-Point Response

The student attempts the task, but the response is incorrect, incomplete, or inaccurate.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

An experiment where a student can test to see what influence chloroplast has on plants is having TWO of the same plants, planted in the same soil with the same amount of water. (in the same temperature) You put one plant in a dark enviornment and the other plant in a light enviornment and you leave them for a couple days. To see what happened, look at the color of the plants, the chloroplasts provide food, energy, and color to the leaf. The plant that was in the dark probably died and lost all of it's color because in order for the claroplasts to work they need sunlight. The one that was in the sun shald look healthey.

Controls in Experiment:

- Same plant
- Same temperature of the enviornment

Variables in Experiment:

- Different settings - one in the light, one in the dark
- the color of the plant - it changes depending on what enviornment it is in

Score Point: 3

This student demonstrates a clear understanding of the use of experimental controls and variables, and provides a relevant and plausible experimental design strategy for measuring the influence of chloroplast activity in plants. It does remain unlikely that after only a few days, "the plant in the dark probably died and lost all of its green color."

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

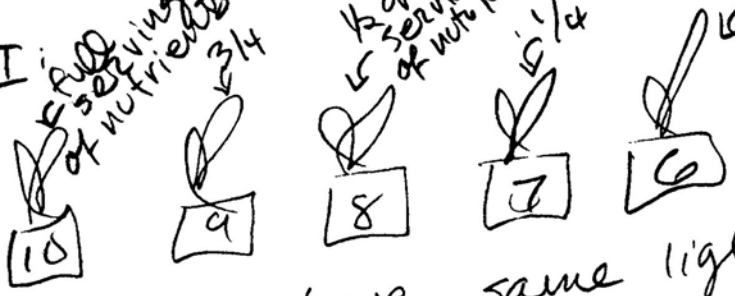
16. To measure the chloroplast activity in plants, two variables could be light and amount of nutrients in the soil. Controls are water and light or soil.

experiment

Part I: Light all day; 3/4 daylight; 1/2 daylight; 1/4 daylight; no light

- all 5 have same soil and amount of water; light varies.

Part II: full servings of nutrients; 3/4; 1/2 of full servings of nutrients; 1/4; no nutrients added



- all 5 have same light + water, different amounts of nutrients added to soil.

> perform the experiment every day for a week

> if plants lose some of their greenness, then sign of less chloroplastic activity.

Score Point: 3

This student demonstrates a clear understanding of the task by identifying two controls and two sets of variables, and providing a relevant and plausible experimental design. The design is a bit confusing since it is difficult to determine whether the goal is to determine if chloroplast activity is more affected by varying "sunlight" or "the different amounts of nutrients."

SCIENCE – PART 1
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16. A student wants to measure the influence of chloroplast activity in plants. Two controls are: ① same type of plant ② same amount of food & water given.

Two variables would be: ① different amount of light to each plant ② notice the different color each plant turns

An experiment using ten plants would be:
- buy 10 of the same type of plant
- give each plant 10ml of food and water every day
- set each plant in a different location each recieving a different amount of sunlight
- Do this for seven days straight
- Record your information

# hrs of sunlight	0	1	2	3	4	5	6	7	8	9	10
color											
growth											

Score Point: 3

This student demonstrates a clear understanding of the task by identifying two controls and two variables, and by providing a relevant and plausible experimental design, which includes a strategy to measure chloroplast activity.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16. ONE control would be to use the same plant another would be to make sure they both get the same amount of Nurishment (Ex use same soil, same amount of watering).

Variables would be having one in a dark room and one in a lighted room, and leaving one outside and one inside.

Put 5 plants in a dark room and 5 in a well lighted room or outside water both the same amount and View how they grow / develop.

Score Point: 2
This student demonstrates adequate understanding of the task by identifying two controls and two possible variables, and by providing a partial experimental design.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16. The student could use two variables amount of sunlight and amount of water. The two controls the use could be amount of soil and amount of water.

An Experiment that could be preformed would have to be an experiment with varried sunlight.

With Ten plants you would have five plants in the shade while five would be in the sun. And make sure each plant is treated the same with same amount of water and care. Then record all observations of both plants Ten days observations. This checks chloroplast because they use sun for food.

Score Point: 2

This student demonstrates an adequate understanding of the task by identifying two controls and two possible variables, and by providing a relevant and plausible experimental design. The student could have elaborated on the design by using a "measurable variable" that is linked to a strategy to measure for chloroplast activity.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

Controls

- how much water the plant gets daily
- how much oxygen the plant gets daily

Variables

- amount of sunlight that the plant / plants recieve daily.
- the temperature that the plant is kept in

A person could perform an experiment to measure the influence of chloroplast activity in plants by first planting ten plants in the same amount of soil. The student would have to use the same amount of water in each plant, and ensure that throughout the course of the day they all recieve the same amount of oxygen. Put 2 plants in an enviornment with sun the whole day and a high temperature. Put 2 plants in sun for the day & med temp. Put 2 plants in sun for the day & low temp. Put 2 plants in sun for half the day & high temp. Put 1 plant in a room w/ low sun & med. temp. And 1 plant w/ low sun & low temp. Measure the amount of O_2 in the air at the end of the day, and the amount of glucose each plant produces. Record all observations.

+full sun high temp
+full sun low temp
+full sun med temp
+low sun high temp
+low sun med temp
+low sun low temp

- measure glucose ($C_6H_{12}O_6$)
- release O_2 output

Score Point: 2

This student demonstrates an adequate understanding of the task by identifying two controls and two variables, and by providing a relevant and plausible experimental design. The student's strategy is to measure for chloroplast activity by recording "the amount of oxygen in the air at the end of the day" and "the amount of glucose each plant produced." There is a potential flaw in the design, since two variables, the amount of sunlight and the temperature, are being used simultaneously.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

Chloroplast gives green color to the plants. It plays an important role in the photosynthesis reaction. The sunlight which falls on the leaves are used for the synthesis of food materials. chloroplast also synthesis carbohydrate and oxygen. Sunlight could produce more chloroplast. Take ten potted green plants. Keep five of them in a dark room after two or three weeks you could see a change in the color of the leaves. The plants will be dry. The other five plants which would be placed in the sunlit room remain the same. We can conclude that chloroplast is essential for plants to survive.

Score Point: 1
This student does not identify either two controls or two variables. The student's main focus is to define the role of the chloroplast in food making. A partial experimental design is proposed, but the response is incomplete.

SCIENCE – PART 1
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16. Two controls observed for Chloroplast activity could be the temperature and the amount of water that is used. Two variables observed for chloroplast activity could be how much sunlight the plant gets and what type of plant is used.

- The experiment could be:
  the student gets 5 kinds of one plant, then 5 kinds of another plant. You would put half of them in front of a window, while the other half remains on a shelf somewhere out of the sunlight. Over a week, you would keep them constantly in the same temperature and give each plant the same amount of water every day. The student would then after a week take a recording of how the plants look, and see how the chloroplast in the plants, reacted to their environments.

Score Point: 1

This student demonstrates a partial understanding of the task by initially identifying two possible controls and one variable. One flaw in the student's experimental design appears to be in the choice of plants that are used. "The experiment could be: the student gets 5 kinds of one plant, then 5 kinds of another plant." This strategy would be difficult to use because any conclusions on chloroplast activity would be based on different "kinds" of plants.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

Controls → 1) same plant
2) same soil

Variables → 1) temperature in room
2) Amount watered

Use one plant for the control and in each of the other 9 plants Make their conditions different from each other. To examine if there is any effect on the plants - every week take a sample of each plant. to check the chloroplast activity to make sure it is staying the same. You should also be choosing variables for each plant that you know change chloroplast activity. For example you can change the amount of light & the type of light the plant is exposed. Record all this data and about after 3 weeks compare your results & see if there are any influences of chloroplast activity on each plant.

Score Point: 1

This student demonstrates a partial understanding of the task by initially identifying two possible controls and variables. The two variables the student identifies in bullet #1 are not the same variables used in the experimental design. The student appears to suggest: "in each of the other 9 plants make their conditions different from each other." This strategy would make the collection of data quite difficult.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

Two controls would be the roots and the type of plant. Two variables could be color and size.

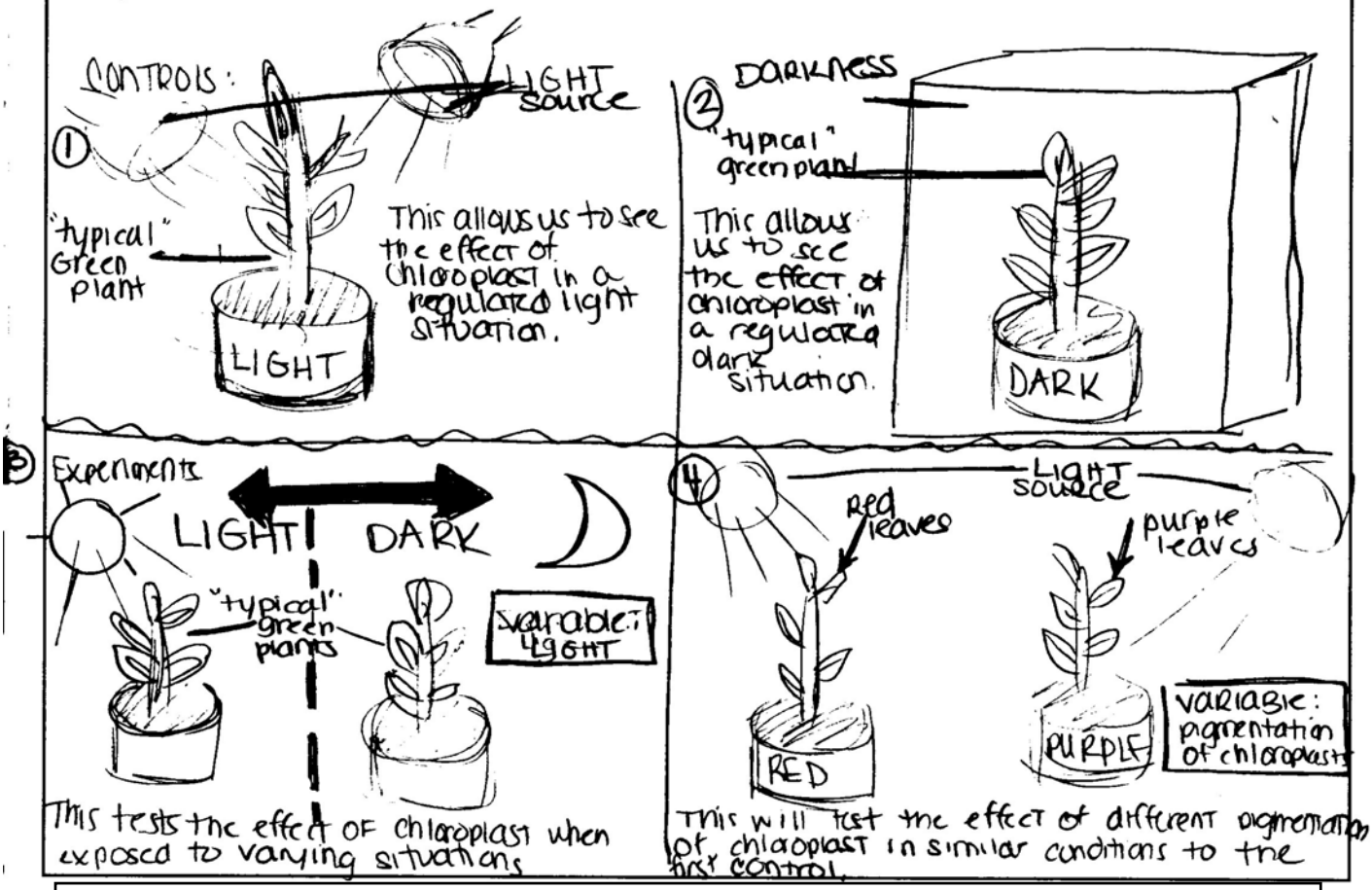
An experiment the student could perform using ten potted plants is they could leave the ten plants in different places to study the amount of chlorophyl present in different lighting and temperatures.

Score Point: 0
This student attempts the task, but the response is incorrect. The student identifies two measurable variables and a set of controls, but does not provide a relevant and plausible experimental design.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16. When measuring the influence of chloroplast activity in plants you must use controls. Two controls may be two regularly watered plants, one in total light (1) (and one can measure the activity of the "light reactions" involving the chloroplasts in the grana of plants) and one in total darkness (2) (where "dark reactions" occur). Two variables could be a plant that switches from light to dark (3) and a plant that may not be a typical green (4) (ie: the chloroplast's pigment is expressed in different ways.)



Score Point: 0

This student attempts the task, but the response is incorrect. It appears that the student is unclear about the terms *variable* and *control*. Although the student provides elaborate artwork to present the experimental design, the setup contains numerous flaws.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 16 only.

16.

The two controls in this experiment could be one plant can be left outside with proper sunlight and water. The other can be left in a house on a window ledge with plenty of sunlight and ~~one~~ water. The ~~two~~ two variables can be to put ~~the~~ a plant that is outside into an area that has no sunlight. The other variable can be to take the water away from a plant that would also be inside on a window ledge. Put three plant outside as the controls and 2 plants inside as the other controls. Put 3 plants outside as the variables (no sunlight) and 2 inside as variables (no water). Measure chloroplast activity in all 10 plants daily to see what influences the chloroplast activity. Run experiment at least a year long.

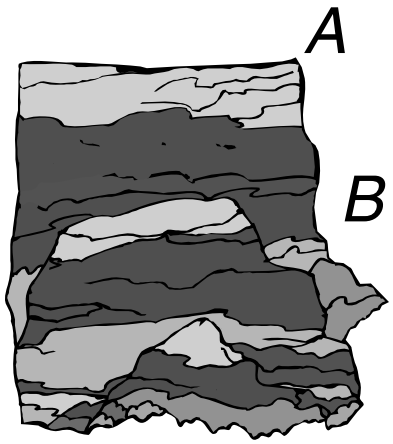
Score Point: 0

This student attempts the task, but the response is incorrect. It appears the student is unclear about the terms *variable* and *control*. The proposed experimental design does not appear to be plausible or relevant.

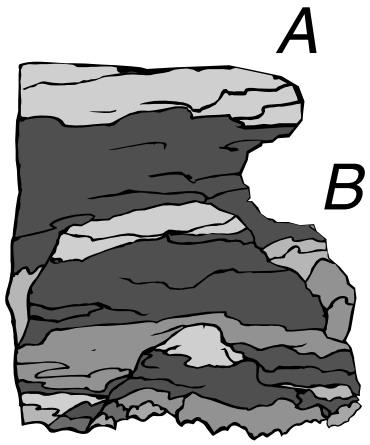
Earth Science Cluster/Structure and Dynamics of Geophysical Systems

Directory of Science Test Specifications: 5.8, p. 12, A, 2, B

Earth is a dynamic system. Some forces build up, some break down Earth's surface.



Cliff Profile
10,000 Years Ago



Cliff Profile
Today

- Identify a type of weathering and explain how it changed this cliff over time. Be sure to explain the reason for the difference between areas A and B.

- Identify and explain a different process that could have changed the cliff, as shown. Be sure to explain the difference between areas A and B.

Sample Response:

- Physical or mechanical weathering through the action of wind or water: There may have been a lake or river flowing past the cliff, and the abrasive action of sediments in the waves or currents could have weathered the cliff. It could be that the rock layer at height B is softer than it is at height A.

- Chemical weathering through water in the rock cycle: The water dissolved stone as it moved through the rock, carrying it away in solution. The stone at height A is less soluble than it is at height B.

Other possibilities:

An earthquake loosened some of the rock, causing it to slide, revealing the present-day features.

OR

Any reasonable explanation, including a reason for the difference between areas A and B.

Scoring Rubric

3-Point Response

The student successfully completes the task by

- providing a relevant weathering process

AND

- an application of that process to the example situation

AND

- an alternate possibility of how the cliff could have changed

AND

- a plausible explanation for the greater weathering at B.

2-Point Response

The student adequately completes the task by

- providing a relevant weathering process

AND

- an application of that process

AND

- a plausible explanation for the greater weathering at B

AND

- an alternate possibility, but is lacking the support to get a 3

OR

- fulfilling the requirements for a 3, but the response contains a conceptual error.

1-Point Response

The student partially completes the task by

- providing a relevant weathering process

AND

- an alternate possibility, but is lacking the support to get a 2

OR

- providing one of the following:
  a description of a relevant weathering process,
  an application of that process to the example situation, or
  a plausible explanation for the greater weathering at B.

0-Point Response

The student attempts the task, but the response is incorrect, incomplete, or inaccurate.

Note: Simply naming a weathering process is not enough to score a 1.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

- Wind eroded the cliff over time because sediment slowly blew across the rock, wearing it down over 10,000 years. Area A was probably covered with vegetation, so it didn't wear away as dramatically as area B because the roots were holding it in place
- The cliff also could have been a riverbed, with A as the shoreline and B underwater, and the current could have worn the face of the rock away and evaporated.

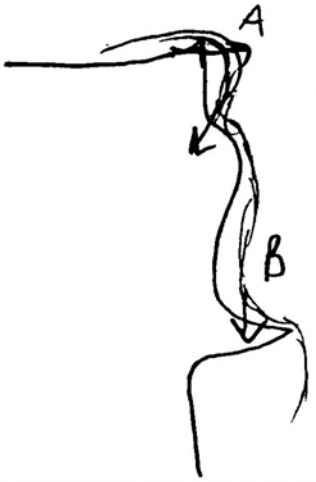
Score Point: 3
This student completes the task by providing a relevant weathering process (although not specifically identifying it), explaining how it changed the cliff over time, and providing a plausible explanation for the greater weathering at point B. In addition, the student provides an alternative possibility of how the cliff could have changed and an alternative explanation for the greater weathering at point B.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

Rain runoff is the main contributer to the change in the Cliffs profile. What would happen is it would rain and since the cliff is slanted slightly towards the face it would runoff. But the hump right above point B caused the water to want to run into the cliff, like rain running down the face of a building when it gets to an over hang, it follows the ceiling. After it did that it continued to run down and carve the nose off of the Cliff that is located below point B. The arrows in the diagram show the direction the water wants to travel in.



a different process could have also been the rock broke off. years of rain, combined with freezing and thawing does a number on rock. just look at the roads after winter. So the big chunk of rock by point B could have popped out after a long winter, and on its way down broke off the nose below B. Point A could have been abraded away over years of wind blowing loose sand and pebbles, just look at how easily a grinder takes away metal.

Score Point: 3

This student successfully completes the task by providing a relevant weathering process, two plausible explanations for the greater weathering at B, and an alternative possibility of how the cliff could have changed over time.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

Something that could have changed the rock is rain. Over time the rain would be hitting on the cliff wearing it away. area A is a harder rock and there for does not erode has quickly as B which may be a softer sandstone.

Another thing that could have change the Rock is the constant wind Blowing on it with dirt in it. It is like it is being "Sand-Blasted" Weaving away part "B" more than part "A" because part "B" is a softe Rock

Score Point: 3

This student successfully completes the task by providing a relevant weathering process (although not specifically identifying it), explaining how it changed the cliff over time, and providing a plausible explanation for the greater weathering at point B. In addition, the student provides an alternative possibility of how the cliff could have changed (mechanical weather/abrasion) and provides an alternative explanation for the greater weathering at point B.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

- Rain changed the cliff overtime for area b because it is a softer layer of rock and was eaten away by the water

- A land slide of falling rock could of took a chunk out A is bigger because it is stronger

Score Point: 2
This student provides one alternate possibility of how the cliff could have changed over time and two explanations for the greater weathering at point B. The student fails to identify a weathering process in bullet #1.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

One option for the type of weathering that occurred would be wind erosion. Because it is a rock face it is subject to the horizontal winds. Presumably the darker matter was less dense than the lighter rock and was therefore worn away more easily. Once wind started being trapped in the crevasse it had to escape and that is why the other rocks around it are rounded.

Another option is water erosion. The water could have dripped down from the top and rounded that top edge. Afterward, it wore away at the less dense rock and made the crevasse, and then moved on to round the edges below it. Also, the small cliff just below part B was filled in by the mineral deposits.

Score Point: 2

This student provides two natural processes that could have changed the cliff's appearance over time and a plausible explanation for the greater weathering at site B. However, the question asks for a weathering process in bullet #1, and the student begins with an explanation of "wind erosion."

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32. • Water erosion ~~or sand erosion~~

A.) Rain slid down the cliff rounding the edge.

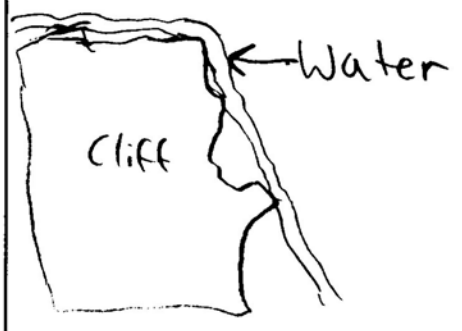
B.) Solfter soil, Water drickles inward and stays in the soil.

• Wind erosion.

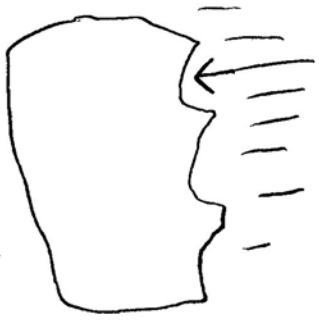
A.) Wind could beat sand and other particles against the cliff rounding it off.

b.) That soil is weaker/solfter and is easier to shape.

Water erosion



Wind



Score Point: 2

This student provides two natural processes that could have changed the cliff's appearance over time, plus a plausible explanation for the greater weathering at site B. However, the question asks for a weathering process in bullet #1, and the student begins with an explanation of water "erosion." A graphic is included in the answer.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32. A type of weathering that could have made a difference between A+B is water running off of the cliff. which would slowly change it,
Another process that could have made the change would be the expansion of ice on the cliff. This would slowly erode the rock.

Score Point: 1
This student has partially completed the task by supplying two possible causes for the cliff's appearance. Unfortunately, the student fails to supply an accurate explanation of how each natural process contributed to the cliff's current appearance or a reason for the differences between areas A and B.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32. One type of weathering that could have changed the cliff's profile over time is wind erosion. The wind began to wear away at the cliff, smoothing out the jagged rock in the area B, and completely erasing the lump as well as taking more in section A.

Another process that could have caused this change was a collision of 2 tectonic plates. The resulting earthquakes and ground movements could have knocked the parts loose, and made them look different.

Score Point: 1
This student has partially completed the task, explaining how wind could have worn away the cliff. Unfortunately, the question asks for a weathering process and the response talks about wind erosion. An alternative possibility is provided, but it lacks the support to give this paper a 2.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32. Ocean weathering could be the reason for such an erosion. Area B could have been hit by waves over the years and the force of the waves crashing on that part of the cliff resulted in an erosion like the one shown in the cliff profile today. 10,000 years ago A was a jagged rock. Today, however, A is smooth rounded. If the rock had been exposed to water for thousands of years it would have caused the cliff to smoothen.

Another process could be wind erosion. Wind erosion would cause A to become smoother. Additionally, The jagged edge of B would have become smoother as well. As for the erosion of B, the wind could have weakened the cliff + caused part of it to fall out.

Score Point: 1
This student has partially completed the task by identifying two possible causes for the cliff's appearance, but fails to give an accurate explanation of how each natural process accounts for the cliff's current appearance.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

A type of weathering that could change this cliff over time could be an earthquake. When the earthquake occured it caused loose rocks to fall, Part of A and B fell apart. Part of A broke of and over time waves made it rounder.

A different process that could have occured was a tetonic plate crashed into it. The plate could have knock part B apart and rounded over part A

Score Point: 0

This student attempts the task but does not provide a relevant weathering process responsible for changing the cliff's appearance. The student incorrectly chooses to discuss "an earthquake" and a "tectonic plate crashed into it" as being responsible for the cliff's current appearance.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

A type of weathering that occured during time over years in the cliff was erosion. Certain types of weather, wind and precipation caused area A to go from a sharp corner to a rounded edge, it caused part B to weather away and some of the cliff was chipped off. Erosion would be the process that changed the cliff and it happens by weather, wind or precipation.

Score Point: 0

This student attempts the task but does not provide a relevant weathering process responsible for changing the cliff's appearance. The student incorrectly chooses to discuss "erosion" and "weather" in both bullets.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

You can tell that in the first picture there is little to none erosion due to rain or what not. However, in the second picture point A becomes an overhang of an indentation due to erosion and the jagged rock under poin B no longer is jagged.

Perhaps humans did this to the cliff as well. Perhaps native Americans dug out the cliff to live in.

Score Point: 0
This student attempts the task but does not provide a relevant weathering process responsible for changing the cliff's appearance. The student has chooses to discuss "erosion" in bullet #1 rather than "weathering."

Physical Science Cluster/Chemistry/Chemical Reactions

Directory of Science Test Specifications: 5.6, p. 8, B, 1, 2

Chemical reactions depend on the collision between the reacting particles to form new combinations of atoms.

Hydrogen and oxygen react to form water, as shown below.

$$2H_2 + O_2 \longrightarrow 2H_2O$$

- Identify two changes produced by this reaction.
- Identify one thing that remains constant during the reaction.

Sample Response:

- Things that change:
  heat energy of the system
  boiling and melting temperatures
  number of molecules
  state/phase (gases become a liquid)
  bond structure
  Elements become a compound.
  Two reactants become one product.
  In the product, hydrogen and oxygen share electrons.

- Things that remain constant:
  number of atoms
  the overall mass of all substances in the system
  the number of protons and neutrons within the atoms

Scoring Rubric

3-Point Response

The student correctly completes the task by

- identifying **two changes** produced by the reaction

AND

- identifying **one** thing that remains **constant** during the reaction.

2-Point Response

The student adequately completes the task by

- identifying **two changes** produced by the reaction

OR

- identifying **one change** produced by the reaction

AND

- identifying **one** thing that remains **constant** during the reaction.

1-Point Response

The student demonstrates a partial understanding of the task by

- identifying **one change** produced by the reaction

OR

- identifying **one** thing that remains **constant** during the reaction.

0-Point Response

The student attempts the task, but the response is incorrect, incomplete, or inaccurate.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32. When two diatomic molecules of hydrogen react with one diatomic molecule of oxygen, two changes that occur are

- the sharing of e^- between two hydrogen atoms and an oxygen atom to form two molecules of H_2O
- likely, a small amount of energy is released from the formation of 4 O–H bonds (change in enthalpy)

One thing that remains constant throughout the reaction is the number of protons in each atom.

Score Point: 3
This student successfully completes the task by identifying two changes produced by the reaction and identifying one thing that remains constant.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32. $2H_2 + O_2 \rightarrow 2H_2O$

change 1: Two separate elements combine to form one compound.

change 2: The reactants being combined are both gases. The product however is a liquid.

One thing that remains constant is the number of atoms involved in the reaction. 4 hydrogen atoms go into the reaction, and 4 come out but they are connected to oxygen atoms to form water (H_2O).

Score Point: 3
This student successfully completes the task by identifying two changes produced by the reaction and identifying one thing that remains constant.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32. In this reaction the states of the 2 reactants change when they become the products. The reactants go from the diatomic molecules of gaseous hydrogen and oxygen to liquid water or H_2O. Another change that occurs is the arrangement of the atoms. In the product the 2 reactants are combined to form 1 thing. In any reaction the amount of atoms never changes. Just the arrangement of the atoms changes.

Score Point: 3
This student successfully completes the task by identifying two changes produced by the reaction and identifying one thing that remains constant.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32. one thing that changes is the two gases combine to form a liquid. The thing that remains constant is the mass. Another thing that changes is originally there are two molecules, but they bond to end up with one molecule.

Score Point: 2
This student adequately completes the task by identifying "one thing that changes is the two gases combine to form a liquid" and "the thing that remains constant is the mass."

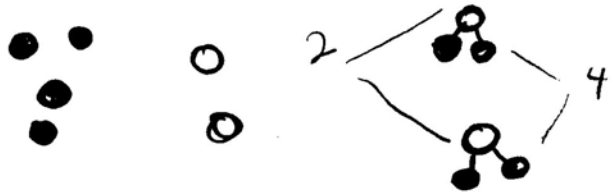
SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

The state of the matter changes. H_2 and O_2 are both gasses, but when combined form a liquid. Also, where there were 3 objects in the beginning (2 H_2 atoms, 1 O_2 atom) there are two molecules afterward,

However, there is one thing that does not change: How many atoms there are:



2 H_2 (4) O_2 (2)

START → FINISH

Score Point: 2
This student adequately completes the task by identifying one change produced by the reaction ("the state of the matter changes") and identifying one thing that remains constant during the reaction ("how many atoms there are").

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

The reaction $2H_2 + O_2 \rightarrow 2H_2O$ changes hydrogen and oxygen into water. Before the reaction, the H_2 and O_2 are gases, but after the reaction the products are liquid. Also, the two different reactants form a single product. During the reaction, the temperature can remain constant because water is a liquid at room temperature, but H_2 and O_2 are gases.

Score Point: 2

This student adequately completes the task by identifying two changes produced by the reaction: "The reaction $2H_2 + O_2 \rightarrow 2H_2O$ changes hydrogen and oxygen into water (liquid). Before the reaction, the H_2 and O_2 are gases" and by stating that "two different reactants form a single product."

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

- One change noticeable was how the $2H_2+O_2$ was combined to form $2H_2O$. Another change was how in the first reaction there were 4 Hydrogen atoms and 2 Oxygen atoms separately but then turned to become 2 water molecules.

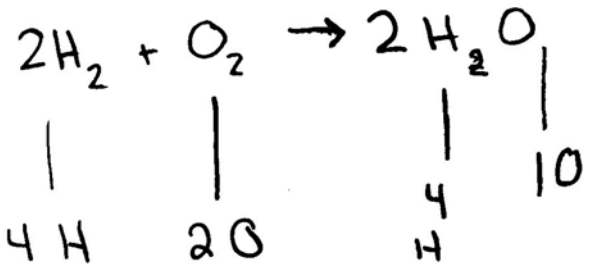
- The constant thing in this reaction was the number of Hydrogen atoms and Oxygen atoms.

Score Point: 1
This student is given partial credit for the task for stating that "the constant thing in this reaction was the number of Hydrogen atoms and Oxygen atoms."

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.



- compound is formed
- one molecule of oxygen is lost when distributed with the hydrogen.

Score Point: 1
This student partially completes the task by providing one change produced by the reaction in bullet #1: "compound is formed."

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32. You take gas and make them liquad, and also change elements into a mixture.

one thing that remains same is H_2

Score Point: 1
This student is given partial credit for the task for correctly recognizing one change produced: "you take gas and make them liquid."

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32.

$$2H_2 + O_2 \rightarrow 2H_2O$$

- Two changes that occured were the combination/reaction of Hydrogen and oxygen, and the second is the result of water.

- One thing that remains constant is H_2. There is no change made to H_2 (Hydrogen). There was initially two atoms of Hydrogen and in the result there are two atoms of Hydrogen as well

Score Point: 0
This student attempts the task, but the response is incorrect.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32. The 2 oxygens has been turned in to $2H_2O$. One thing that remains constant is the hydrogen.

Score Point: 0
This student attempts the task, but the response is both incorrect and incomplete.

SCIENCE
OPEN-ENDED RESPONSE

Use this page for question 32 only.

32. Two changes produced by this combination are heat and a different element. Heat is created when the two ~~elements~~ combine. The new element is also a result of the combination.

One thing that remains constant through the reaction is the number of separate molecules. Before and after the reaction there are 4 hydrogens and 2 oxygens. Those numbers stay constant.

Score Point: 0
This student attempts the task, but the response is incorrect. The student writes, "Two changes are heat and a different element" and "one thing that remains constant through the reaction is the number of separate molecules."