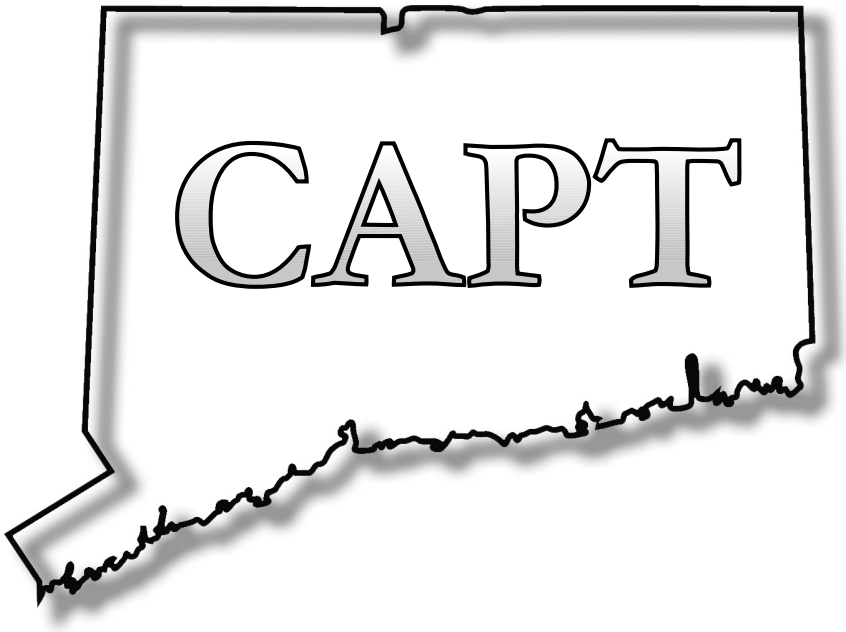
CAPT Science
2007 Administration



Released Items and
Scored Student Responses

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CAPT Science Framework

The CAPT Design and Framework for the Assessment of Science was developed with the input of Connecticut educators and reflects a growing national consensus that science is not only a body of knowledge, but also a way of thinking about the world around us and a concern for how that knowledge is used. The Science test thus assesses students' understanding of important scientific concepts, as well as their application of those concepts to realistic problems. In addition, experimentation and the ability to use scientific reasoning to solve problems are a major focus of the test.

The new Connecticut Science Framework approved by the Connecticut State Board of Education in October 2004 serves as the foundation of the CAPT. The framework delineates the core content knowledge and inquiry skills all students are expected to master by the time they are assessed on the CAPT. The CAPT assesses the expected performances listed in the right hand column for both the inquiry and content standards in the Connecticut Science Framework. One marked change from the second to the third generation of the CAPT science assessment is the increase in items that assess scientific reasoning and communication skills, also known as scientific inquiry skills. The percentage of questions that assess scientific inquiry skills has increased from 22 percent to 47 percent of the assessment. These test items will be in the form of constructed response and multiple-choice questions.

Assessing Conceptual Understandings and Applications
The goal of teaching scientific concepts is to increase students' understanding of the natural world around them. What does it mean to understand a concept? For the CAPT, understanding a concept means going beyond the recall of facts to using one's knowledge to describe, explain, and make predictions about various phenomena based on that knowledge.

Science does not exist in a vacuum. Rather, it is a vital part of today's world, serving to inform and advance society. For this reason, students need to be able to apply scientific reasoning and knowledge to solve daily life and technological problems. In addition, students need to be able to communicate scientific understandings through words, graphs, charts, and equations. The assessment of conceptual understanding and applications includes both multiple-choice and open-ended questions.

The science test assesses conceptual understanding and applications of scientific knowledge and experimentation in five content domains: (1) Energy Transformations; (2) Chemical Structures and Properties; (3) Global Interdependence; (4) Cell Chemistry and Biotechnology; and (5) Genetics, Evolution and Biodiversity.

Assessing Experimentation

The performance task associated with previous CAPT generations has been eliminated from the Third Generation CAPT. The CSDE has provided five suggested curriculum-embedded performance tasks for teachers to use in the normal course of instruction. The tasks are posted online at http://www.ct.gov/sde under the curriculum menu in the science content area. Each of the five content strands has an inquiry laboratory investigation and a Science, Technology, and Society (STS) activity. The activities are provided in Microsoft Word format for easy modification by classroom teachers to meet individual student needs. These tasks are strongly suggested but not mandated and will remain in place throughout the Third Generation CAPT. A teacher may prefer to use a pre-existing laboratory or STS activity to assess student understanding of the expected performances identified in any of the curriculum-embedded tasks. The five constructed responses that appear on the CAPT use the context of the tasks, either the laboratory investigation or the STS, to assess scientific inquiry skills. Each test includes one constructed response per content strand that results in a total of five constructed responses.

Core Science Curriculum Framework for Grades 9 and 10

THE STANDARDS FOR SCIENTIFIC INQUIRY, LITERACY, AND NUMERACY ARE INTEGRAL PARTS OF THE CONTENT STANDARDS FOR EACH GRADE LEVEL IN THIS CLUSTER.

Grades 9–10 Core Scientific Inquiry, Literacy, and Numeracy

How is scientific knowledge created and communicated?

Content Standards	Expected Performances
SCIENTIFIC INQUIRY ♦ Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. ♦ Scientific inquiry progresses through a continuous process of questioning, data collection, analysis, and interpretation. ♦ Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. **SCIENTIFIC LITERACY** ♦ Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. ♦ Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. **SCIENTIFIC NUMERACY** ♦ Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze, and present scientific data and ideas.	**D INQ.1** Identify questions that can be answered through scientific investigation. **D INQ.2** Read, interpret and examine the credibility and validity of scientific claims in different sources of information. **D INQ.3** Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment. **D INQ.4** Design and conduct appropriate types of scientific investigations to answer different questions. **D INQ.5** Identify independent and dependent variables, including those that are kept constant and those used as controls. **D INQ.6** Use appropriate tools and techniques to make observations and gather data. **D INQ.7** Assess the reliability of the data that was generated in the investigation. **D INQ.8** Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms. **D INQ.9** Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation. **D INQ.10** Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.

Grade 9

Core Themes, Content Standards and Expected Performances

Strand I: Energy Transformations

Content Standards	Expected Performances
Energy Transfer and Transformations – What is the role of energy in our world? **9.1 - Energy cannot be created or destroyed; however, energy can be converted from one form to another.** ♦ Energy enters the Earth system primarily as solar radiation, is captured by materials and photosynthetic processes, and eventually is transformed into heat.	**D 1.** Describe the effects of adding energy to matter in terms of the motion of atoms and molecules, and the resulting phase changes. **D 2.** Explain how energy is transferred by conduction, convection and radiation. **D 3.** Describe energy transformations among heat, light, electricity and motion.
Energy Transfer and Transformations – What is the role of energy in our world? **9.2 - The electrical force is a universal force that exists between any two charged objects.** ♦ Moving electrical charges produce magnetic forces, and moving magnets can produce electrical force. ♦ Electrical current can be transformed into light through the excitation of electrons.	**D 4.** Explain the relationship among voltage, current and resistance in a simple series circuit. **D 5.** Explain how electricity is used to produce heat and light in incandescent bulbs and heating elements. **D 6.** Describe the relationship between current and magnetism.
Science and Technology in Society – How do science and technology affect the quality of our lives? **9.3 - Various sources of energy are used by humans and all have advantages and disadvantages.** ♦ During the burning of fossil fuels, stored chemical energy is converted to electrical energy through heat transfer processes. ♦ In nuclear fission, matter is transformed directly into energy in a process that is several million times as energetic as chemical burning. ♦ Alternative energy sources are being explored and used to address the disadvantages of using fossil and nuclear fuels.	**D 7.** Explain how heat is used to generate electricity. **D 8.** Describe the availability, current uses and environmental issues related to the use of fossil and nuclear fuels to produce electricity. **D 9.** Describe the availability, current uses and environmental issues related to the use of hydrogen fuel cells, wind and solar energy to produce electricity.

Grade 9

Core Themes, Content Standards and Expected Performances

Strand II: Chemical Structures and Properties

Content Standards	Expected Performances
Properties of Matter – How does the structure of matter affect the properties and uses of materials? **9.4 - Atoms react with one another to form new molecules.** ♦ Atoms have a positively charged nucleus surrounded by negatively charged electrons. ♦ The configuration of atoms and molecules determines the properties of the materials.	**D 10.** Describe the general structure of the atom, and explain how the properties of the first 20 elements in the Periodic Table are related to their atomic structures. **D 11.** Describe how atoms combine to form new substances by transferring electrons (ionic bonding) or sharing electrons (covalent bonding). **D 12.** Explain the chemical composition of acids and bases, and explain the change of pH in neutralization reactions.
Properties of Matter – How does the structure of matter affect the properties and uses of materials? **9.5 – Due to its unique chemical structure, carbon forms many organic and inorganic compounds.** ♦ Carbon atoms can bond to one another in chains, rings and branching networks to form a variety of structures, including fossil fuels, synthetic polymers and the large molecules of life.	**D 13.** Explain how the structure of the carbon atom affects the type of bonds it forms in organic and inorganic molecules. **D 14.** Describe combustion reactions of hydrocarbons and their resulting by-products. **D 15.** Explain the general formation and structure of carbon-based polymers, including synthetic polymers, such as polyethylene, and biopolymers, such as carbohydrate.
Science and Technology in Society – How do science and technology affect the quality of our lives? **9.6 - Chemical technologies present both risks and benefits to the health and well-being of humans, plants and animals.** ♦ Materials produced from the cracking of petroleum are the starting points for the production of many synthetic compounds. ♦ The products of chemical technologies include synthetic fibers, pharmaceuticals, plastics and fuels.	**D 16.** Explain how simple chemical monomers can be combined to create linear, branched and/or cross-linked polymers. **D 17.** Explain how the chemical structure of polymers affects their physical properties. **D 18.** Explain the short- and long-term impacts of landfills and incineration of waste materials on the quality of the environment.

Grade 9

Core Themes, Content Standards and Expected Performances

Strand III: Global Interdependence

Content Standards	Expected Performances
The Changing Earth – How do materials cycle through the Earth's systems? **9.7 - Elements on Earth move among reservoirs in the solid earth, oceans, atmosphere and organisms as part of biogeochemical cycles.** ♦ Elements on Earth exist in essentially fixed amounts and are located in various chemical reservoirs. ♦ The cyclical movement of matter between reservoirs is driven by the Earth's internal and external sources of energy.	**D 19.** Explain how chemical and physical processes cause carbon to cycle through the major earth reservoirs. **D 20.** Explain how solar energy causes water to cycle through the major earth reservoirs. **D 21.** Explain how internal energy of the Earth causes matter to cycle through the magma and the solid earth.
Science and Technology in Society – How do science and technology affect the quality of our lives? **9.8 - The use of resources by human populations may affect the quality of the environment.** ♦ Emission of combustion by-products, such as SO_2, CO_2 and NOx by industries and vehicles is a major source of air pollution. ♦ Accumulation of metal and non-metal ions used to increase agricultural productivity is a major source of water pollution.	**D 22.** Explain how the release of sulfur dioxide (SO_2) into the atmosphere can form acid rain, and how acid rain affects water sources, organisms and human-made structures. **D 23.** Explain how the accumulation of carbon dioxide (CO_2) in the atmosphere increases Earth's "greenhouse" effect and may cause climate changes. **D 24.** Explain how the accumulation of mercury, phosphates and nitrates affects the quality of water and the organisms that live in rivers, lakes and oceans.
Science and Technology in Society – How do science and technology affect the quality of our lives? **9.9 - Some materials can be recycled, but others accumulate in the environment and may affect the balance of the Earth systems.** ♦ New technologies and changes in lifestyle can have positive and/or negative effects on the environment.	**D 25.** Explain how land development, transportation options and consumption of resources may affect the environment. **D 26.** Describe human efforts to reduce the consumption of raw materials and improve air and water quality.

Grade 10

Core Themes, Content Standards and Expected Performances

Strand IV: Cell Chemistry and Biotechnology

Content Standards	Expected Performances
Structure and Function – How are organisms structured to ensure efficiency and survival? **10.1 - Fundamental life processes depend on the physical structure and the chemical activities of the cell.** ♦ Most of the chemical activities of the cell are catalyzed by enzymes that function only in a narrow range of temperature and acidity conditions. ♦ The cellular processes of photosynthesis and respiration involve transformation of matter and energy.	**D 27.** Describe significant similarities and differences in the basic structure of plant and animal cells. **D 28.** Describe the general role of DNA and RNA in protein synthesis. **D 29.** Describe the general role of enzymes in metabolic cell processes. **D 30.** Explain the role of the cell membrane in supporting cell functions.
Science and Technology in Society – How do science and technology affect the quality of our lives? **10.2 - Microorganisms have an essential role in life processes and cycles on Earth.** ♦ Understanding the growth and spread patterns of viruses and bacteria enables the development of methods to prevent and treat infectious diseases.	**D 31.** Describe the similarities and differences between bacteria and viruses. **D 32.** Describe how bacterial and viral infectious diseases are transmitted, and explain the roles of sanitation, vaccination and antibiotic medications in the prevention and treatment of infectious diseases. **D 33.** Explain how bacteria and yeasts are used to produce foods for human consumption.
Science and Technology in Society – How do science and technology affect the quality of our lives? **10.3 - Similarities in the chemical and structural properties of DNA in all living organisms allow the transfer of genes from one organism to another.** ♦ The principles of genetics and cellular chemistry can be used to produce new foods and medicines in biotechnological processes.	**D 34.** Describe, in general terms, how the genetic information of organisms can be altered to make them produce new materials. **D 35.** Explain the risks and benefits of altering the genetic composition and cell products of existing organisms.

Grade 10

Core Themes, Content Standards and Expected Performances

Strand V: Genetics, Evolution and Biodiversity

Content Standards	Expected Performances
Heredity and Evolution – What processes are responsible for life's unity and diversity? **10.4. - In sexually reproducing organisms, each offspring contains a mix of characteristics inherited from both parents.** ♦ Genetic information is stored in genes that are located on chromosomes inside the cell nucleus. ♦ Most organisms have two genes for each trait, one on each of the homologous chromosomes in the cell nucleus.	**D 36.** Explain how meiosis contributes to the genetic variability of organisms. **D 37.** Use the Punnet Square technique to predict the distribution of traits in mono- and di-hybrid crossings. **D 38.** Deduce the probable mode of inheritance of traits (e.g., recessive/dominant, sex-linked) from pedigree diagrams showing phenotypes. **D 39.** Describe the difference between genetic disorders and infectious diseases.
Heredity and Evolution – What processes are responsible for life's unity and diversity? **10.5 - Evolution and biodiversity are the result of genetic changes that occur over time in constantly changing environments.** ♦ Mutations and recombination of genes create genetic variability in populations. ♦ Changes in the environment may result in the selection of organisms that are better able to survive and reproduce.	**D 40.** Explain how the processes of genetic mutation and natural selection are related to the evolution of species. **D 41.** Explain how the current theory of evolution provides a scientific explanation for fossil records of ancient life forms. **D 42.** Describe how structural and behavioral adaptations increase the chances for organisms to survive in their environments.
Science and Technology in Society – How do science and technology affect the quality of our lives? **10.6 - Living organisms have the capability of producing populations of unlimited size, but the environment can support only a limited number of individuals from each species.** ♦ Human populations grow due to advances in agriculture, medicine, construction and the use of energy. ♦ Humans modify ecosystems as a result of rapid population growth, use of technology and consumption of resources.	**D 43.** Describe the factors that affect the carrying capacity of the environment. **D 44.** Explain how change in population density is affected by emigration, immigration, birth rate and death rate, and relate these factors to the exponential growth of human populations. **D 45.** Explain how technological advances have affected the size and growth rate of human populations throughout history.

Items Found in This Packet

Open-Ended Items

Open-ended items are those for which a student must write a short response to a question. Included in this packet are the five open-ended items corresponding to the curriculum-embedded performance tasks.

CSDE has developed a suggested performance task for each of the five content strands in the science framework for Grades 9–10. Teachers are encouraged to use these tasks in the normal course of instruction when teaching the related content strand. The five constructed response items on the CAPT will assess scientific inquiry, literacy and numeracy using the context of the curriculum embedded tasks. These constructed response items total 15 points or 20 percent of the total test.

CAPT open-ended items are scored on a four-point scale (0–3) using a holistic scoring method. This method involves judging the overall quality of the student response. The general scoring rubric for the science open-ended items (see following page) describes the characteristics of a response at each score point. Included with each item is the content guide (description of a good response to the question), the specific scoring rubric for the item (description of each score point), and the classification of the item based on the CAPT Science Framework. This is followed by two scored student responses at each score point along with a brief discussion of why the response received a particular score.

Keep in mind that the scoring criteria are based on reasonable expectations of grade ten students responding under testing conditions. Students are given approximately five minutes to respond to each open-ended item. The responses are therefore less polished than they might be if students were given more time to revise their answers. In addition, students are asked to respond to a wide variety of scientific topics, many of which they may not have studied for some time. All of this is taken into consideration when scoring the responses.

Multiple-Choice Items

For each of the five content strands, eight multiple-choice items assess content knowledge and four multiple-choice items assess scientific inquiry, literacy, and numeracy skills. The entire Science test includes 60 multiple-choice items.

To foster depth of understanding, most CAPT multiple-choice items are organized in clusters related to particular scenarios. In addition, some clusters include specific information at the beginning which students can use in answering the questions. To stress the interdisciplinary nature of science, some clusters make connections between concepts of the major content areas.

Scoring Rubric for Science Open-Ended Items

Each score category contains a range of student responses which reflect the descriptions given below.

Score 3
The response is an excellent answer to the question. It is correct, complete, and appropriate and contains elaboration, extension, and/or evidence of higher-order thinking and relevant prior knowledge. There is no evidence of misconceptions. Minor errors will not necessarily lower the score.

Score 2
The response is a proficient answer to the question. It is generally correct, complete, and appropriate, although minor inaccuracies may appear. There may be limited evidence of elaboration, extension, higher-order thinking, and relevant prior knowledge, or there may be significant evidence of these traits but other flaws (e.g., inaccuracies, omissions, inappropriateness) may be more than minor.

Score 1
The response is a marginal answer to the question. While it may contain some elements of a proficient response, it is inaccurate, incomplete and/or inappropriate. There is little if any evidence of elaboration, extension, higher-order thinking, or relevant prior knowledge. There may be evidence of significant misconceptions.

Score 0
The response, although on topic, is an unsatisfactory answer to the question. It may fail to address the question, or it may address the question in a very limited way. There may be no evidence of elaboration, extension, higher-order thinking, or relevant prior knowledge. There may be evidence of serious misconceptions.

CAPT Science Open-Ended Item:
Decontamination Process

Decontamination Process

A process (phytoremediation) has been developed that uses plants to remove contaminants from soils and water. Suppose a contaminated area (Brownfield site) in your town is being considered for this process. Identify at least three questions that would need to be answered before starting such a program.

Write your answer in your answer booklet.

Rubric for *Decontamination Process*

Possible Correct Responses:

- What is/were the sources of contamination?
- What are/were the contaminants of concern?
- What is the extent of the affected property?
- How deep does the contamination extend into the sediment?
- What are the potential effects on the local ecosystem/food webs?
- What type of ecological restoration is being sought (recreation, residential, etc.)?
- What is the timeframe needed for total restoration?
- What is the cost associated with this program compared to other programs?
- What special resources (tools, people, etc.) are required?
- Other acceptable questions.

3-Point Rubric:

Score 3
The response provides at least three relevant questions that would need to be answered before a town implements a phytoremediation program.

Score 2
The response provides two questions that would need to be answered before a town implements a phytoremediation program.

Score 1
The response provides one question that would need to be answered before a town implements a phytorernediation program.

Score 0
The response provides little or no accurate or relevant information.

Strand III: Global Interdependence

Expected Performance: D INQ.1 Identify questions that can be answered through scientific investigation.

Scored Student Responses for *Decontamination Process*

Score 3

1) Can the area support plant life?

2) Where is the funding coming from

3) What will be done with the plants after contamination is depleted?

4) How long will process take?

The response provides several (4) valid questions that would need to be answered before using a phytoremediation process to decontaminate a Brownfield site.

Scored Student Responses for *Decontamination Process*

Score 3

One question that needs to be identified is, what contaminants are in the soils and water in the first place? You need to know this because it will be easier to find out how to remove the contaminants. The second question I have would be, how big is Brownfield Site? I need to know this simply because I would need to know how much materials and supplies are needed to remove the contaminants. My last question is, how does phytoremediation work? I would need to know this just in case we need other processes or supplies to remove the contaminants.

This response provides three valid questions: "…what contaminants are in the soils and water," "how big is Brownfield site?" and "how does phytoremediation work?" This response also provides elaboration as to why the questions are being asked.

Scored Student Responses for *Decontamination Process*

Score 2

1. Is this site the habitat of many plants and animals that may be harmed by the process?
2. Are the contaminants necessary for carrying out any natural processes?
3. What are the contaminants?

This response provides two valid questions that receive credit (#1 and #3). The second question provided "Are the contaminants necessary for carrying out any natural processes?" is a misconception that contaminants could be beneficial in some way and does not receive credit.

Scored Student Responses for *Decontamination Process*

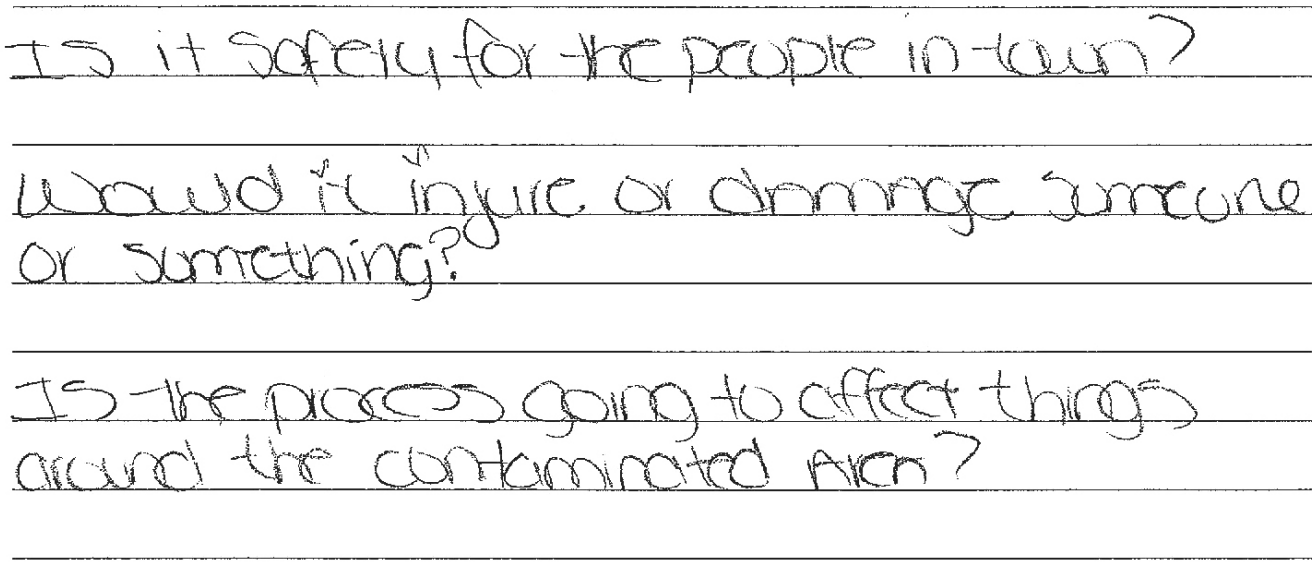
Score 2

One question would be, won't the
proess effect the plant life?
2. & if the plants got effected then
won't the animals that eat the
plants get sick?
And 3. How long would it take for
all of this to happen?

This response provides three questions. However, the first two questions "…won't the process effect [sic] the plant life?" and "if the plants get effected [sic] then won't the animals that eat the plants get sick?" are addressing the same issue – whether the process affects the surrounding environment/area – which only receives one point. The third question is another valid point.

Scored Student Responses for *Decontamination Process*

Score 1



This response provides three questions that basically address the same issue of whether the process is safe for the surrounding area. These are counted as just one valid question.

Scored Student Responses for *Decontamination Process*

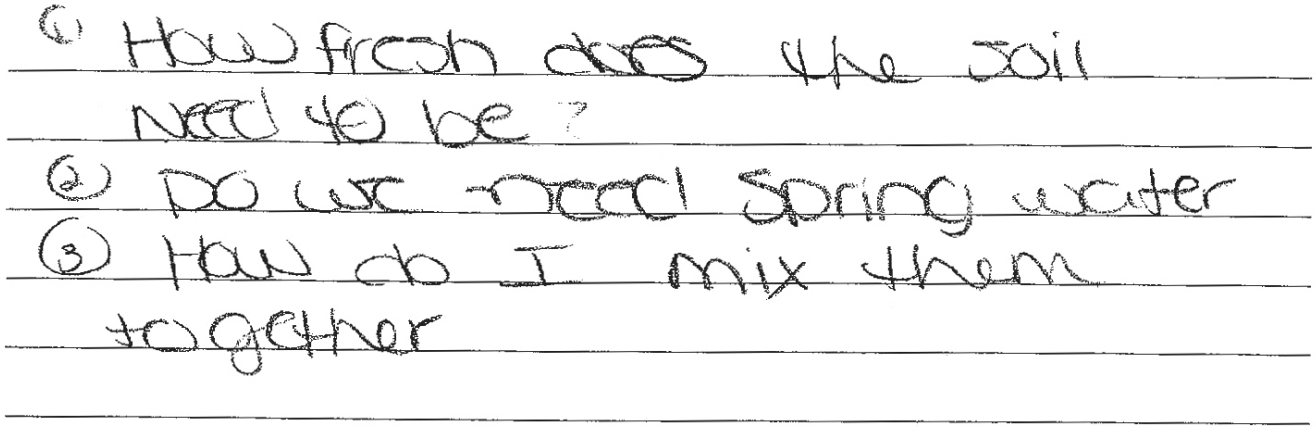
Score 1

1. What will happen to the plants once they remove the waste from the soil and water?

The response provides one valid question.

Scored Student Responses for *Decontamination Process*

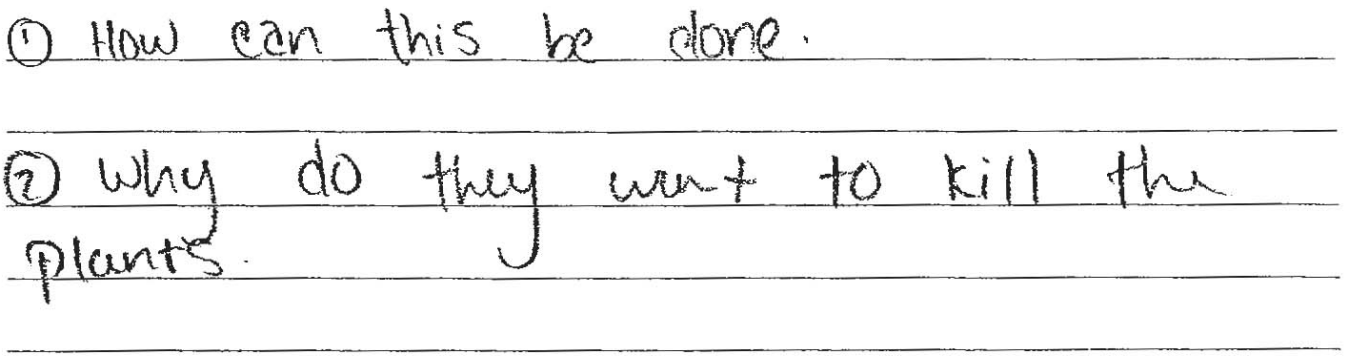
Score 0



This response provides three questions that may be attempting to ask about the growing conditions for the plants but are too vague to receive any credit.

Scored Student Responses for *Decontamination Process*

Score 0



This response's first question "how can this be done?" is too vague to receive credit for asking how the process of phytoremediation works. The second question "why do they want to kill the plants?" is a misconception that also doesn't receive credit.

CAPT Science Open-Ended Item:
Enzymes

Enzymes

Science students conducted an investigation to determine how enzymes affect apple juice production.

Procedure:

1. Place coffee filter in paper cone; cut off 2 cm of the bottom of the cone, leaving a small hole.
2. Place 30 mL of apple sauce into measuring cup, add 5 drops of enzyme A solution, and stir thoroughly.
3. Place a graduated cylinder under paper cone and add apple sauce to coffee filter, stirring every minute.
4. Measure volume of apple juice in cup after 5 minutes using graduated cylinder.
5. Repeat steps 1–4 for a second trial.
6. Repeat steps 1–5 using enzyme B solution.
7. Repeat steps 1–5 using water.

Amount of Juice Produced

Enzyme Solution	Trial 1 (mL)	Trial 2 (mL)	Average (mL)
A	14	15	14.5
B	6	5	5.5
Water	5	5	5.0

a) Identify two variables that were held constant in the group's experiment.

b) Explain why it is important for these variables to be held constant.

Write your answer in your answer booklet.

Rubric for *Enzymes*

Possible Correct Responses:

- the amount of apple sauce used in measuring cup for each trial
- the number of drops of each enzyme used in each trial (volume)
- the stirring of the apple sauce (done every minute)
- the amount of time enzyme is allowed to act before measuring apple juice
- the cut off of 2 cm of the bottom of the cone allowing the apple juice to drain

If any of these factors are not controlled, they could affect the results preventing the students from drawing a valid conclusion.

If the students were to test more than one variable at a time, they would not be able to tell which variable is responsible for the results or if it was a combination of both.

3-Point Rubric:

Score 3
The response clearly identifies two specific variables that were held constant and provides an explanation that addresses the validity of the results in terms of testing too many variables at once.

Score 2
The response clearly identifies two variables that were held constant but fails to provide a clear explanation of why it is important to hold these variables constant.

-or-

The response clearly identifies one variable that was held constant and provides an explanation that addresses the validity of the results in terms of testing too many variables at once.

Score 1
The response clearly identifies one variable that was held constant but fails to provide a clear explanation of why it is important to hold this variable constant.

-or-

The response provides a clear explanation of why it is important to hold variables constant without clearly identifying any of the variables that were held constant.

Score 0
The response provides little or no accurate or relevant information.

Strand IV: Cell Chemistry and Biotechnology

Expected Performance: D INQ.5 Identify independent and dependent variables, including those that are kept constant and those used as controls.

Scored Student Responses for *Enzymes*

Score 3

a. The amount of apple sauce initially and the time waited before measuring the volume were both held constant

b. It's important to hold them constant so the results don't get messed up by having more than one variable change at a time. If this happens you won't know exactly why you got the results you did and if they're accurate

This response correctly identifies two variables that were held constant, "the amount of apple sauce" and "the time waited before measuring the volume [of juice]," and correctly explains why it is important to keep these variables constant, "…so the results don't get messed up by having more than one variable change at a time."

Scored Student Responses for *Enzymes*

Score 3

A. Two variables held constant were the amounts of apple sauce and the # of drops of either the enzyme or water, and the amount of time (5 mins) was also constant.

B. These variable are very important to be held constant because if different amounts of apple sauce or drops of enzyme were used for each trial, then the results may be inacurate. Also if you left the apple sauce for different amounts of time, then the ones there longer would make more juice.

This response correctly identifies three variables that were held constant, "…the amounts of apple sauce, the # of drops of the enzyme…and the amount of time (5 mins.)…" and correctly explains why it is important to keep these variables constant: "if you left the apple sauce for different amounts of time, then the ones there longer would make more juice."

Scored Student Responses for *Enzymes*

Score 2

a) The first variable was the amount of apple sauce that was put in the measuring cup. The other variable that was held constant was the amount of enzyme solution put into the apple sauce

b) It is important to keep these variables constant so your experiment is correct. Your experiment wouldn't prove anything if everything was different and didn't make any sense.

This response correctly identifies two variables held constant "the amount of apple sauce" and "the amount of enzyme solution," but fails to provide an adequate explanation of why this is necessary in the experiment.

Scored Student Responses for *Enzymes*

Score 2

Two variables that were kept constant are the 30 mL of apple sauce and the 5 drops of the enzyme solution. This means that all of the solutions contained the same amount of apple sauce and that apple sauce was exposed to the same amount of enzyme in each of the solutions.

This response correctly identifies two variables to be held constant, "…the 30 mL of apple sauce and the 5 drops of the enzyme solution," but does not explain why it is important that the same amount of apple sauce be exposed to the same amount of enzyme.

Scored Student Responses for *Enzymes*

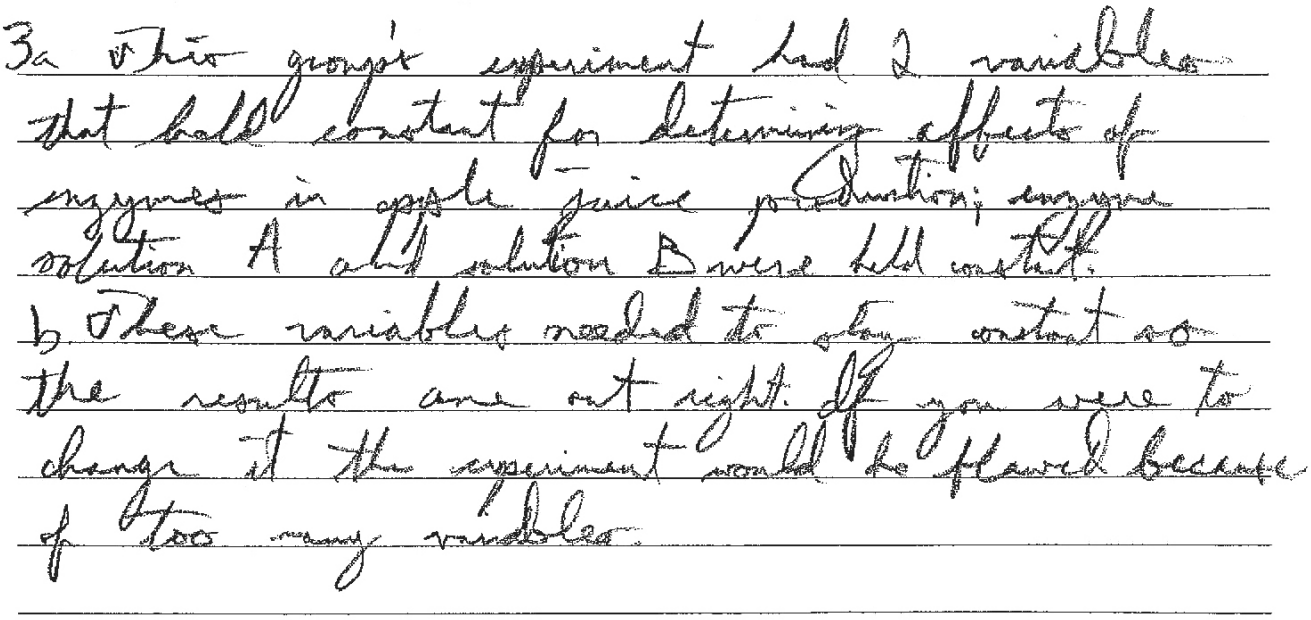
Score 1

Water was the same the entire time. And the other one is the 5 minute time period. Those are the 2 variables.

This response correctly identifies one variable that was held constant, "the 5 minute time period." Water does not receive credit because it is the control in this experiment, not a variable. The response does not attempt to explain why the variables should remain constant.

Scored Student Responses for *Enzymes*

Score 1



This response does not receive credit for the variables "enzyme solution A and enzyme solution B" remaining constant. The enzyme solutions are the independent variables, which are not held constant. (The amount of the enzyme is the variable that is held constant.) However, the response does correctly explain why the variables should remain constant "…the experiment would be flawed because of too many variables" and receives credit for part b.

Scored Student Responses for *Enzymes*

Score 0

The independent variable was the Enzyme Solutions. The dependent variable was the amount of juice produced after adding the enzyme solution to the apple sauce. These variables must be held constant because these variable are helping you figure out the problem state. Also, you must have control because if you don't you won't know what you're doing.

This response correctly identifies the independent and dependent variables, but these are not held constant during the experiment. No explanation is given on why variables must be held constant.

Scored Student Responses for *Enzymes*

Score 0

A: the two variables that were held constant were the dependent variable and Independent variable.

B: Its important for these variables to be held constant because its all about knowing which chemical depends on something to change it and which one doesn't.

This response does not correctly identify any variables that were held constant, and the explanation for why it is important for these variables to remain constant is too vague to receive credit.

CAPT Science Open-Ended Item:
Stretching Experiment

Stretching Experiment

Students performed the following investigation.

Procedure:

1. Cut a piece of plastic from each of the following:
   - dry-cleaning bag
   - kitchen wrap
   - plastic sandwich bag
   - plastic grocery bag
2. Hold the sample of the dry-cleaning bag between thumb and forefinger.
3. Attach a clamp to the bottom of the sample.
4. Add weights to the clamp and measure the length the plastic stretches.
5. Repeat for other samples.
6. Record data in table.

The students recorded the following data from their investigation.

Stretching Ability

Plastic type	Trial 1
dry-cleaning bag	23 mm
kitchen wrap	16 mm
sandwich bag	14 mm
grocery bag	7 mm

a) After analyzing the data, the students concluded that the data supported their original hypothesis. What could have been the students' hypothesis?

b) Support your answer with specific information from the investigation.

Write your answer in your answer booklet.

Rubric for *Stretching Experiment*

Possible Correct Responses:

- The plastic used to make grocery bags is stronger (less likely to stretch or tear) than the other plastics: the plastic grocery bag stretched 7 mm, which was less than the other plastics.
- The plastic used to make dry cleaning bags is weaker (more likely to stretch or tear) than the other plastics: the plastic dry cleaning bag stretched 23 mm, which was more than the other plastics.
- The plastics used to make sandwich bags and grocery bags have similar strength: the amount of force required to stretch both of these plastics is similar, there was only a 2 mm difference.
- Other acceptable hypotheses.

3-Point Rubric:

Score 3
The response provides a valid hypothesis that is supported by a description that includes specific information from the polymer investigation.

Score 2
The response provides a valid hypothesis that is supported by a general description based on the polymer investigation (some of the plastics stretched more than others).

Score 1
The response provides a valid hypothesis that is not supported by a valid general description based on the polymer investigation.

Score 0
The response provides little or no accurate or relevant information.

Strand II: Chemical Structures and Properties

Expected Performance: D INQ.3 Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.

Scored Student Responses for *Stretching Experiment*

Score 3

Their original hypothesis could have been that the grocery bag would stretch the least and/or that the dry-cleaning bag would stretch the most because that is what happened: the dry-cleaning bag stretched 23 mm, while the grocery bag only stretched 7 mm.

This response provides a valid hypothesis, "the grocery bag would stretch the least and/or that the dry-cleaning bag would stretch the most," supported by specific information from the investigation, "the dry-cleaning bag stretched 23 mm, while the grocery bag only stretched 7 mm."

Scored Student Responses for *Stretching Experiment*

Score 3

a) The students' hypothesis could have been that the dry-cleaning bag had the highest amount of stretchability.
b) This is because the plastic that stretched the most was the dry-cleaning bag sample (at 23 mm). If this was their hypothesis, then the data does in fact support it.

This response provides a valid hypothesis, "the dry-cleaning bag had the highest amount of stretchability," and supports it with specific information from the investigation, "the plastic that stretched the most was the dry-cleaning bag sample (at 23 mm)."

Scored Student Responses for *Stretching Experiment*

Score 2

a) If you place weights on a clamp on a piece of plastic then the dry-cleaning bag will stretch the farthest because it doesn't need to be as strong as a grocery bag would need to be.
b) the dry-cleaning bag stretched the most while the grocery bag stretched the least

This response provides a valid hypothesis, "…the dry-cleaning bag will stretch the farthest…" and supports it with general information from the investigation, "the dry-cleaning bag stretched the most…."

Scored Student Responses for *Stretching Experiment*

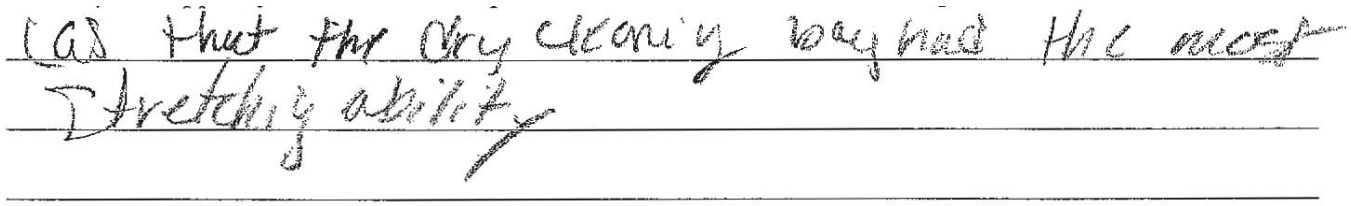
Score 2

There hypothesis could of been that the dry cleaning bag would of stretched the farthest. This could of been it because it was proven after doing the experiment because it did stretch the farthest. Or there hypotheses could of been that the grocery bag would of stretched the least out of all the plastic. This is proven because it did stretch the least.

This response provides two valid hypotheses with general support, "…the dry-cleaning bag would of [sic] stretched the farthest…because it did stretch the farthest" and "…the grocery bag stretched the least…because it did stretch the least."

Scored Student Responses for *Stretching Experiment*

Score 1



This response provides a valid hypothesis but does not provide any support from the investigation.

Scored Student Responses for *Stretching Experiment*

Score 1

a- the hypothesis could have been that the students guessed the dry-cleaning bag was going to stretch the furthest.

b- what leads me to this thought is that the dry-cleaning bag was the first material the students tested which means they would most likely have tested the material they thought would have the furthest stretch first, they would be anxious to see if they were right in guessing.

This response provides a valid hypothesis but does not provide any valid support from the experiment. The order the materials were tested is irrelevant.

Scored Student Responses for *Stretching Experiment*

Score 0

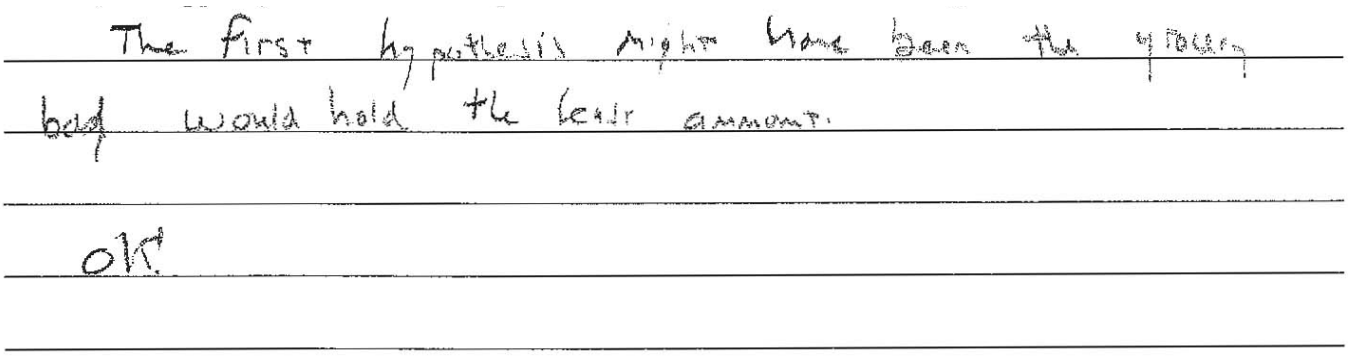
A. A dry-cleaning bag will be able to withstand more weight than any of the others.

B. The hypothesis is correct because a dry cleaning bag did withstand more weight than any other bag.

This response provides an incorrect hypothesis with incorrect support. The student may have mistaken "mm" for a unit of mass.

Scored Student Responses for *Stretching Experiment*

Score 0

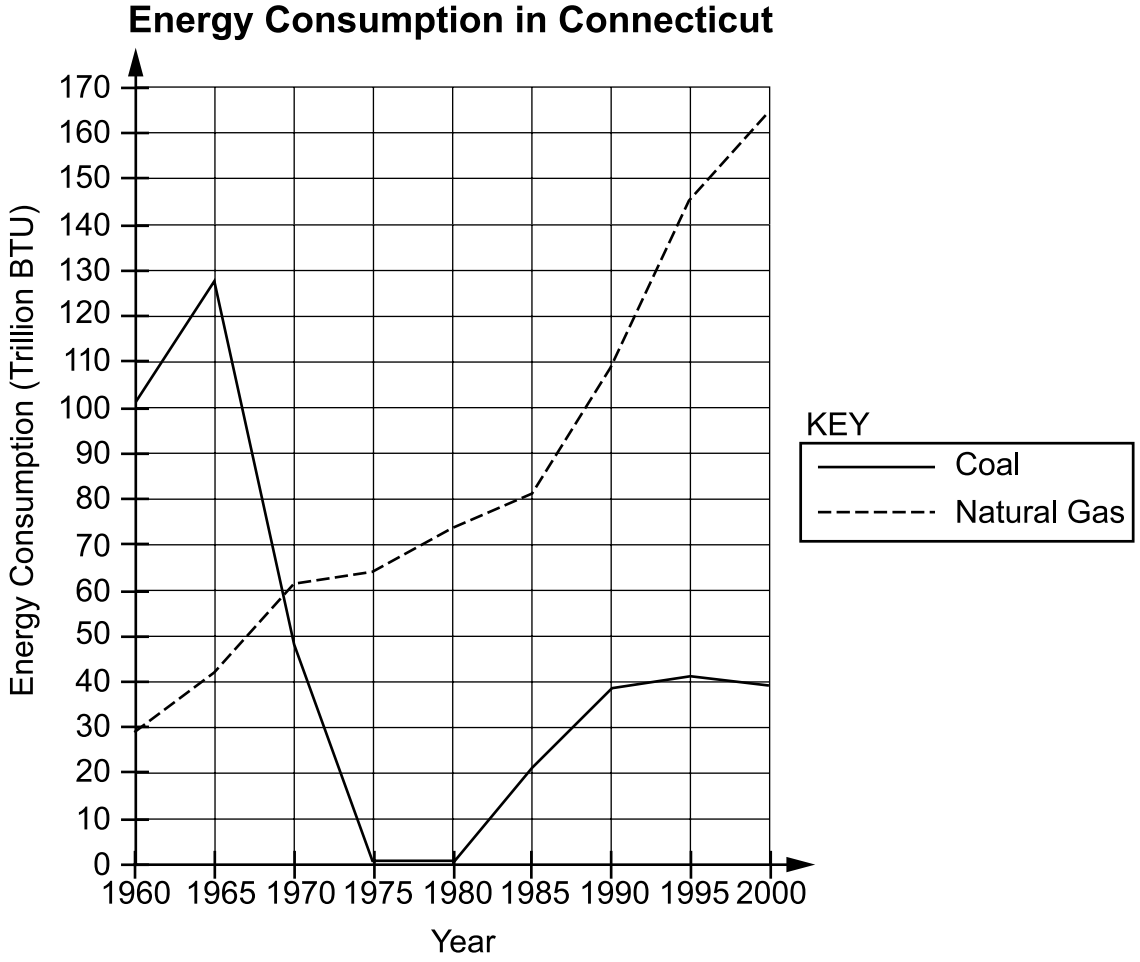


This response provides an incorrect hypothesis without any support from the investigation.

CAPT Science Open-Ended Item:
Energy Consumption

Energy Consumption

The graph below shows the energy consumption for coal and natural gas in Connecticut for 40 years.



a) Describe the overall trend for coal or natural gas from 1960–2000.

b) Make a prediction regarding the energy consumption of coal or natural gas for the year 2015.

c) Support your prediction with specific information from the graph.

Write your answer in your answer booklet.

Rubric for *Energy Consumption*

Possible Correct Responses:

Trend:

- **Coal**: coal use has varied over the 40-year period, from very high in the 1960s to almost zero in the late 70s. Its use has been moderate since 1990.
- **Coal**: coal use has declined overall from the beginning of the 40-year period.
- **Natural Gas**: natural gas use has increased relatively consistently since 1960.

Coal

Prediction:

- The consumption of coal for 2015 will be approximately 40 trillion BTU.
- The consumption of coal will stay level.
- The consumption of coal for 2015 will be less than 40 trillion BTU.
- The consumption of coal will continue to decline.
- The consumption of coal for 2015 cannot be predicted with any degree of confidence.

Support:

- Coal consumption from 1990 to 2000 has been relatively stable at about 40 trillion BTU.
- Coal use since 1990 peaked at 40 trillion BTU and has started to decline.
- Coal use plummeted from almost 130 trillion BTU in 1965 to almost nothing from 1975 to 1980.

Natural Gas

Prediction:

- The consumption of natural gas for 2015 will exceed 165 (or any number above that up to 250) trillion BTU.
- Consumption of natural gas has increased from 30 trillion BTU in 1960 to over 160 trillion BTU in 2000 and there is no evidence that this trend will change.
- The consumption of natural gas for 2015 will continue to increase but at a slower rate.

Support:

- Natural gas consumption has increased 20 to 30 trillion BTU for every 5 years that pass; therefore, it can be expected to continue increasing by this amount.
- Consumption of natural gas has increased from 30 trillion BTU in 1960 to over 160 trillion BTU in 2000, and there is no evidence to suggest that this trend will change in the future.
- From 1985 to 1995, consumption of natural gas increased by 30 trillion BTU for each 5 years that passed. From 1995 to 2000 it dropped off to a 20 trillion BTU increase. It can be expected to keep increasing, but at a slower rate.

Note: Math errors aren't penalized.

3-Point Rubric:

Score 3
The response describes the overall trend of either coal or natural gas and makes a valid prediction. The prediction is supported with specific information from the graph.

Score 2
The response describes the overall trend of either coal or natural gas and makes a valid prediction but fails to provide sufficient support for the prediction.

-or-

The response makes a valid prediction and supports the prediction with specific information from the graph but fails to accurately describe the overall trend of the resource.

Score 1
The response describes the overall trend of either coal or natural gas but fails to make a reasonable prediction.

-or-

The response makes a valid prediction but fails to provide sufficient support for the prediction and fails to describe the overall trend.

Score 0
The response describes little or no accurate or relevant information.

Strand I: Energy Transformation

Expected Performance: D INQ.7 Assess the reliability of the data that was generated in the investigation.

Scored Student Responses for *Energy Consumption*

Score 3

a) the trend from 1960 - 2000 in coal is that the consumption greatly decreased so by 1975, the consumption was at 0 and slowly rose again to about 38 Trillion BTU in 2000. For natural gas, the slope gradually rose until 1995 when it shot up from 80 trillion BTU to 163 trillion BTU in 2000.

b) In 2015 consumption of coal should slowly decline to about 30 trillion BTU and about 190 trillion BTU for natural gas.

c) I came to these conclusions because the consumption of coal slowly rose again and peaked in 1995 at 40 trillion and then was starting to slowly decline. The consumption of natural gas was rising pretty steadily and if the line of the graph was extended it would hit at about 190 trillion in the year 2015.

This response describes the overall trends for both coal and natural gas usage from 1960–2000 and then makes a prediction for each. The prediction for coal is supported with specific information from the graph "…the consumption of coal slowly rose again and peaked in 1995 at 40 trillion and then was starting to slowly decline."

Scored Student Responses for *Energy Consumption*

Score 3

A) The overall trend for natural gas is that it has greatly increased over the 40 years. It never went down, but always steadily rose, and the consumption rose the most from '85 to '95.

B) In 2015, natural gas will most likely be consumed at about 250 trillion BTU.

C) In the past, gas consumption has increased by over 80 trillion BTU (1985 - 2000), about 45 trillion BTU (1975 - 1990), and 70 trillion BTU (1980 - 1995). Because the trend keeps increasing, it will probably rise about 90 trillion BTU (to 250).

This response describes the overall trend for natural gas and also makes an acceptable prediction for natural gas that is supported with specific information from the graph.

Scored Student Responses for *Energy Consumption*

Score 2

The overall trend for natural gas consumption from 1960-2000 was an increasing demand for the product, due to new technology. The energy consumption for natural gas in 2015 will not increase as rapidly but still be higher than the slowly increasing coal consumption, due to the limits of these resources. I believe this because natural gas made a huge leap over the past couple decades, so supplies are quickly decreasing, while coal will make a come back into the energy consumption world.

This response describes the overall trend for natural gas and also makes an acceptable prediction for natural gas, but the prediction is not supported with specific information from the graph.

Scored Student Responses for *Energy Consumption*

Score 2

A. The trend of natural gas started off a little low then got more use then around 1985 it sky rocketed.

B. I predict, for coal, in 2015, it will be in the low 20's as for natural gas, it will stay steady and decline a little bit.

C. I predicted that for coal because it was almost non-existant in the 1920's and in 1995, it slowly started declining, but for gas, it had a very high number and will stay steady for a while.

This response describes the overall trend for natural gas. An acceptable prediction is made for coal, but the support is not specific enough to receive any more credit. The prediction and support for natural gas are not valid because the graph doesn't show any evidence that the use of natural gas will decline.

Scored Student Responses for *Energy Consumption*

Score 1

a) The trend for Coal was signifigant in the 1960s but dramatically dropped throughout the 70s. It then rised through the 80s and 90s but it never got back to where it was in the late 60s. Natural Gas since the 1960s has risen tremendously, and now in the 2000s were using it more than we were using coal in the 1960s.

This response describes the overall trends for both coal and natural gas usage from 1960–2000 but does not make any predictions.

Scored Student Responses for *Energy Consumption*

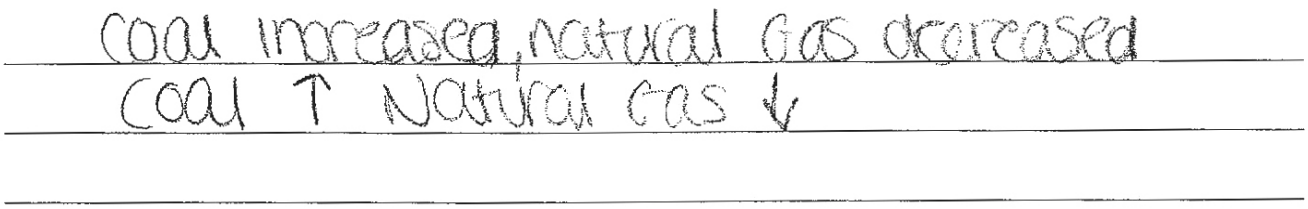
Score 1

Natural gas tends to go up throughout the years. I predict by the year 2015 natural gas will begin to slowly decrease because of new developments in electricity and solar power

This response briefly describes the overall trend for natural gas and also makes a prediction for natural gas, but the prediction is not valid because the graph doesn't show any evidence that the use of natural gas will decline.

Scored Student Responses for *Energy Consumption*

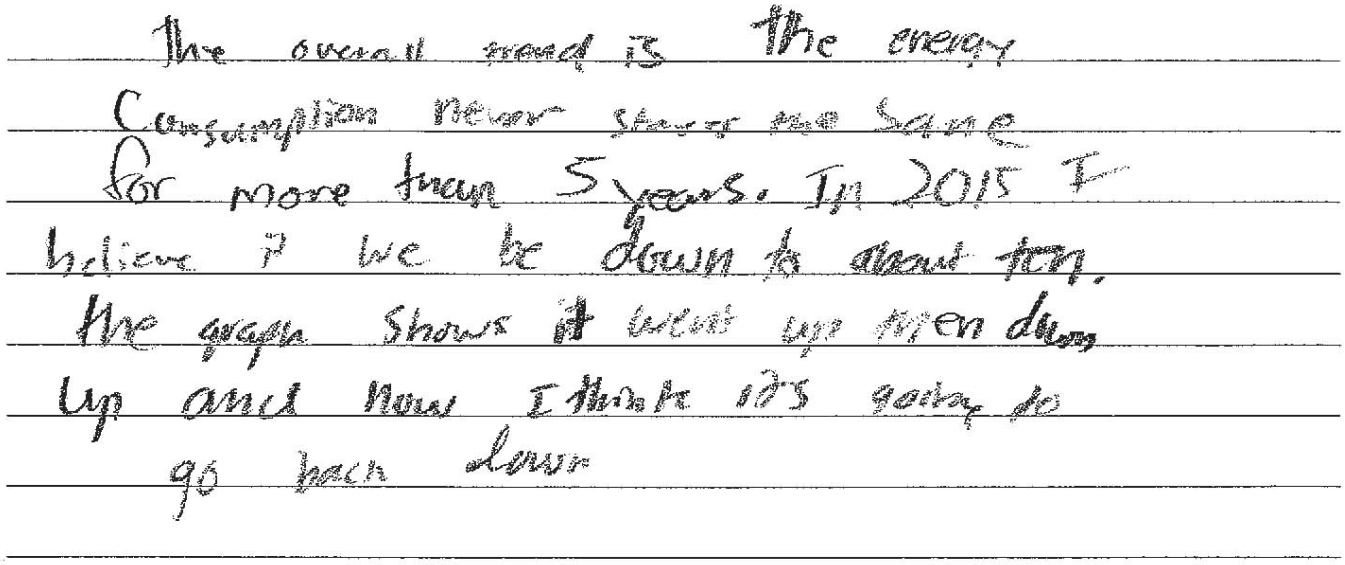
Score 0



This response does not receive any credit because it has reversed the trends for coal and natural gas.

Scored Student Responses for *Energy Consumption*

Score 0



This response describes an overall trend for energy consumption but does not receive any credit because it has not indicated whether the trend is for coal or natural gas.

CAPT Science Open-Ended Item:
Yeast Experiment

Yeast Experiment

A group of students wrote the following procedure for their experiment.

Procedure:

1. Place 35 mL of 25% molasses solution into three small collection tubes.
2. Place 1 mL of the yeast suspension into each collection tube.
3. Place your palm over a small collection tube and mix each suspension well.
4. Carefully slide a larger tube down over the smaller tube. Invert the tube. Repeat for each tube.
5. Measure the height of the bubbles in the smaller tubes and record.
6. Place one tube at 10°C in a refrigerator. Leave the second one out at room temperature at 25°C. Place the third tube in a warming oven at 35°C. Make sure all tubes are in the dark and in an undisturbed location. Leave the three samples for 24 hours.
7. Measure the change in bubble size after 24 hours. Record the data.

The table below shows the results of the group's experiment.

Temperature (in °C)	Height of CO_2 Bubble (in mm)
10	2
25	8
35	10

a) What conclusion can be drawn from the students' experiment and results?

b) Describe two ways the students could have improved their experimental design and/or validity of their results.

Write your answer in your answer booklet.

Rubric for *Yeast Experiment*

Possible Correct Responses:

Conclusions:
- CO_2 production in yeast increases with increasing temperature.
- CO_2 production in yeast decreases with decreasing temperature.

Improvements:
- The students could repeat the experiment to verify their results or do multiple trials at each temperature and average their results.
- The students could add additional trials at higher (and/or lower) temperatures to see if the trend holds.
- The students could perform the test again at smaller temperature increments.
- The students could use a warming oven for the test tube subjected to room temperature (25°C), because in 24 hours, temperatures could fluctuate a few degrees which could affect results.
- The students should use a consistent size for the gas collection tube (not clear in procedure).
- Other acceptable responses.

3-Point Rubric:

Score 3
The response provides a valid conclusion and describes at least two ways the students could improve their experimental design and/or the validity of their results.

Score 2
The response provides a valid conclusion and describes one way the students could improve their experimental design and/or the validity of their results.

-or-

The response describes at least two ways the students could improve their experimental design and/or the validity of their results but fails to provide a valid conclusion.

Score 1
The response provides a valid conclusion but fails to accurately describe a way the students could improve their experimental design and/or the validity of their results.

-or-

The response describes one way the students could improve their experimental design and/or the validity of their results but fails to provide a valid conclusion.

Score 0
The response describes little or no accurate or relevant information.

Strand V: Genetics, Evolution and Biodiversity

Expected Performance: D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

Scored Student Responses for *Yeast Experiment*

Score 3

The conclusion can be made as the temperature increase the height of the CO_2 bubble will increase.

One way the student could have made their results more valid is by doing the experiment twice. Another way is to have another tube in even hotter temperature

This response provides a valid conclusion "…as the temperature increase [sic] the height of the CO_2 bubble will increase" and also provides two valid improvements "doing the experiment twice" and "have another tube in even hotter temperature."

Scored Student Responses for *Yeast Experiment*

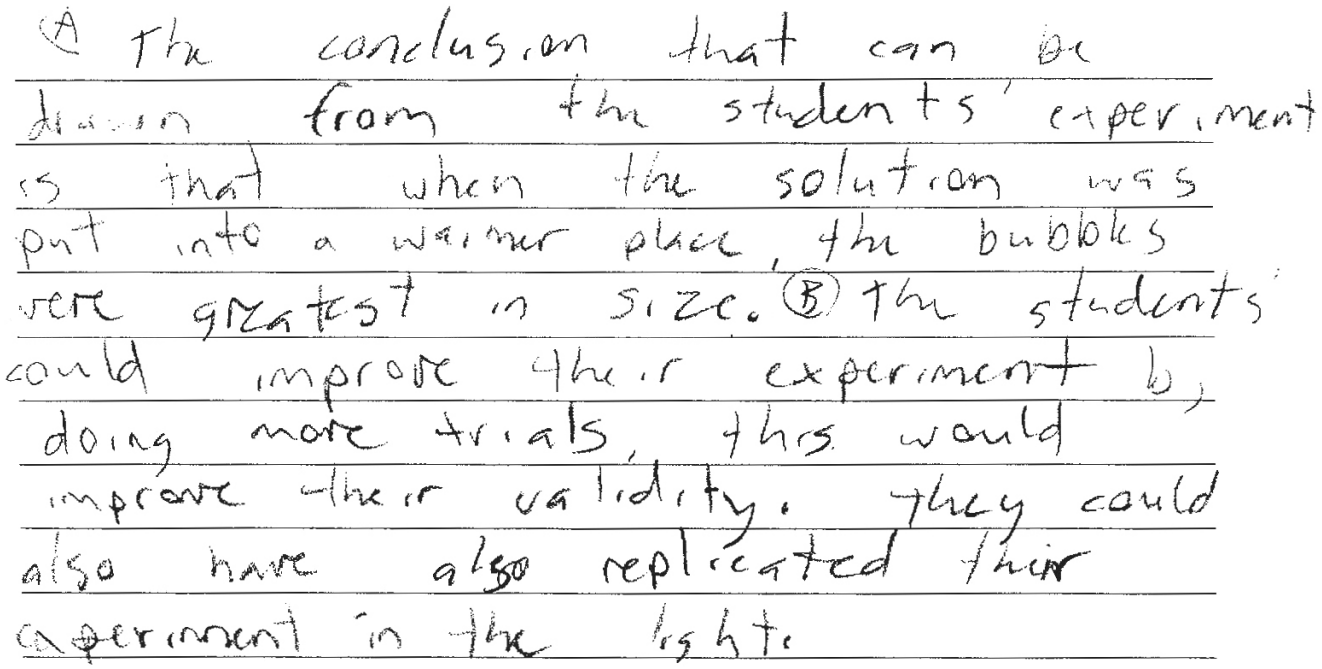
Score 3

a) The conclusion you can draw from this experiment is that a temperature (°C) increases, the height (mm) of CO_2 Bubbles also increase.
b) They can repeat for 3 trials to get more valid results for each temperature. Also instead of putting their palm over the collection tube to mix which might have substance on it which could alter the data, use a clean material to assist in mixing.

This response provides a valid conclusion "…as temperature (C°) increases, the height (mm) of CO_2 Bubbles also increase" and also provides two valid improvements "…repeat for 3 trials" and "use a clean material to assist in mixing" (instead of your palm which may be contaminated).

Scored Student Responses for *Yeast Experiment*

Score 2



This response provides a valid conclusion "…when the solution was put into a warmer place, the bubbles were greatest in size" and provides one valid improvement "doing more trials." Replicating the experiment in the light is not a valid improvement because this would change the experiment.

Scored Student Responses for *Yeast Experiment*

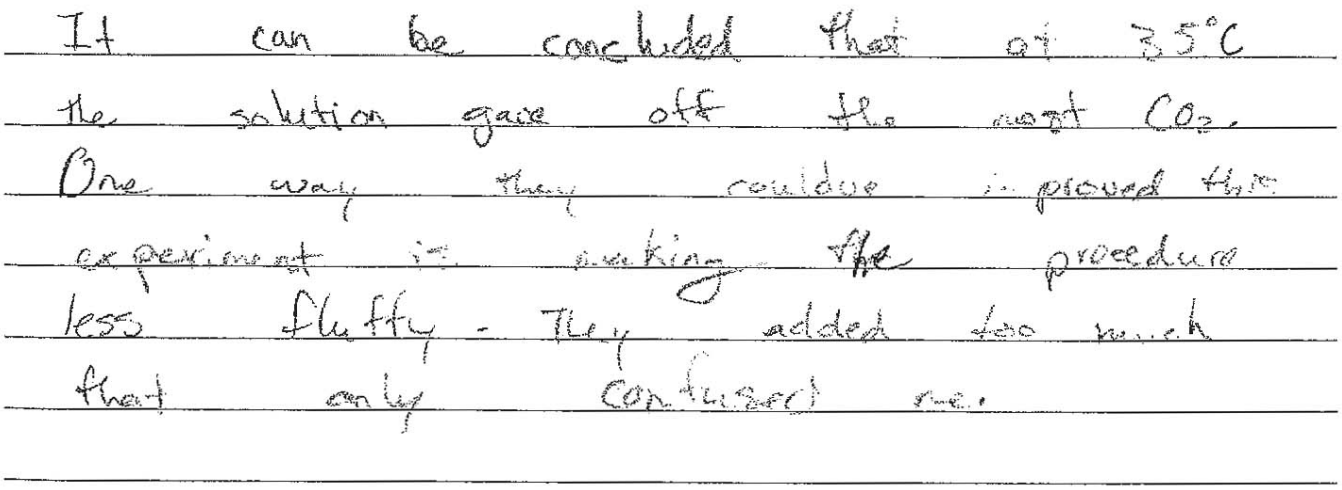
Score 2

We can conclude that as the temperature increases, the height of the CO_2 bubble increases. The students could have improved and made thier results more valid by doing the expirement more than once so that they could compare results.

This response provides a valid conclusion "…as the temperature increases, the height of the CO_2 bubble increases" and provides one valid improvement of doing the experiment more than once.

Scored Student Responses for *Yeast Experiment*

Score 1



This response provides a valid conclusion "…at 35° C the solution gave off the most CO_2." The suggested improvement merely asks for clarification, which does not receive credit.

Scored Student Responses for *Yeast Experiment*

Score 1

a) I concluded that the biggest change in bubble size was the 3rd tube in the oven.

b) The students should say what "investing" is.

This response provides a valid conclusion "…the biggest change in bubble size was the 3rd tube in the oven." (The only tube in the oven was the 35°C tube which makes this statement correct.) Asking for a definition of a word is not a valid improvement.

Scored Student Responses for *Yeast Experiment*

Score 0

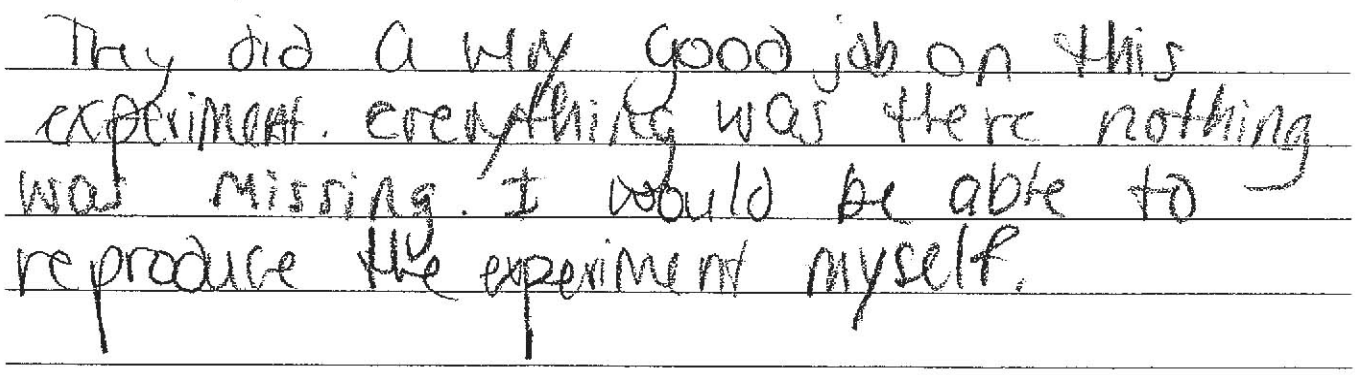
a) The conclusion than can be drawn from the students experiment and results are that it will support the hypothesis completely but the procedure is not that related to the experimentle design. They are missing something.

b) 1 way that the students could have improved their experimental design is that they should have included the % of molases solution in there chart. The second way is that they should have 10°C refrigerator and 25°C underbed boation included into the chart

This response does not provide either a valid conclusion or a valid improvement. Providing more detail to the table does not improve the experimental design and/or the validity of the results and does not receive credit.

Scored Student Responses for *Yeast Experiment*

Score 0



This response does not provide either a valid conclusion or a valid improvement.

CAPT Science Multiple-Choice Questions:
In the Kitchen

Common kitchen appliances include electric stoves, toasters and blenders. Each appliance uses an energy source and involves energy changes to prepare food.

1. An open pot of water is heated on the stove. As water boils, the molecules _____.

f. move slower and closer together
g. move faster and farther apart✪
h. get larger
j. get smaller

Expected Performance: D 1. Describe the effects of adding energy to matter in terms of the motion of atoms and molecules, and the resulting phase changes.

2. When in use, the heating element in a toaster glows and gives off heat. This is because atoms within the heating element _____.

a. undergo chemical reactions
b. are excited by the flow of electrons✪
c. gain electrons and increase in temperature
d. conduct light and heat from the outlet

Expected Performance: D 5. Explain how electricity is used to produce heat and light in incandescent bulbs and heating elements.

CAPT Science Multiple-Choice Questions: *In the Kitchen* (continued)

A group of students carried out the following investigation.

"Our hypothesis is that the greater the wire diameter used in a toaster, the greater the resistance in the wire."

1. We took a 4-meter length of wire with a diameter of 0.5 millimeters.
2. We attached the wire to a 3-volt battery and measured the current.
3. Knowing the voltage and current, we calculated the resistance in the wire.
4. We repeated the same steps with wires of increased diameter.
5. We organized our data in the table below.

Diameter of Wire (millimeters)	Measured Current (milliamps)	Calculated Resistance (ohms)
0.5	10	300.0
1.0	40	75.0
1.5	80	37.5
2.0	100	30.0
2.5	250	12.0

3. To be certain that data in the table are correct, you will have to _____.

f. go online and seek additional information
g. ask for your teacher's opinion
h. repeat the experiment as described✪
j. repeat the experiment with different variables

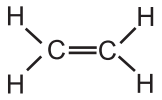
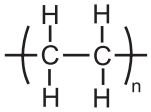
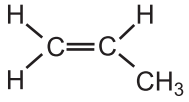
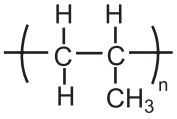
Strand I: Energy Transformation

Expected Performance: D INQ.7 Assess the reliability of the data that was generated in the investigation.

CAPT Science Multiple-Choice Questions: *Plastics*

Consumers use many products made of plastic. Plastics are carbon-based polymers made from smaller carbon compounds, called monomers.

Common Plastics

Plastic	Monomer	Polymer
Polyethylene		
Polypropylene		

1. In organic molecules, the carbon atoms and the hydrogen atoms are held together by _____.

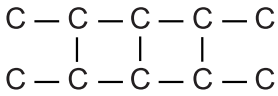
f. hydrogen bonds
g. covalent bonds✪
h. ionic bonds
j. nuclear bonds

Expected Performance: D 13. Explain how the structure of the carbon atom affects the type of bonds it forms in organic and inorganic molecules.

CAPT Science Multiple-Choice Questions: *Plastics* (continued)

A company is considering polymers A and B below for the production of plastic shopping bags.

Branched Polymer A



Linear Polymer B

2. Which polymer is more appropriate for the production of shopping bags?

a. Polymer A, because its branched structure provides greater strength✪
b. Polymer A, because its branched structure provides greater flexibility
c. Polymer B, because its linear structure provides greater strength
d. Polymer B, because its linear structure provides greater flexibility

Expected Performance: D 15. Explain the general formation and structure of carbon-based polymers, including synthetic polymers, such as polyethylene, and biopolymers, such as carbohydrate.

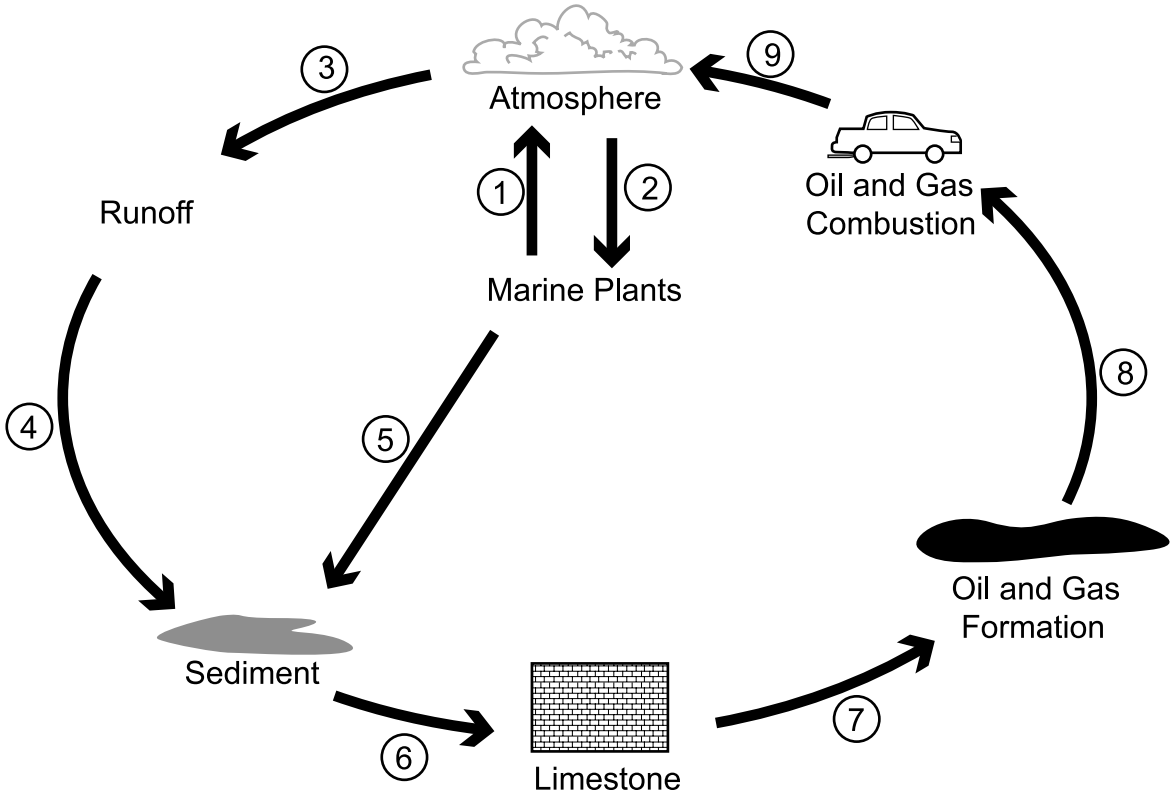
3. Many communities encourage the recycling of plastics, even though it is often expensive to do so. Why is it beneficial to the environment to recycle plastics?

f. Plastics are expensive to manufacture.
g. Plastics are made from renewable resources.
h. Plastics decompose quickly, releasing toxic chemicals.
j. Plastics decompose slowly, taking up space in landfills.✪

Expected Performance: D 18. Explain the short- and long-term impacts of landfills and incineration of waste materials on the quality of the environment.

CAPT Science Multiple-Choice Questions:
Carbon Cycle

The diagram below shows carbon cycling associated with oil and gas consumption.



1. Which arrow on the carbon cycle diagram represents the process that takes the longest amount of time to occur?

f. 1
g. 3
h. 5
j. 7✪

Expected Performance: D 19. Explain how chemical and physical processes cause carbon to cycle through the major earth reservoirs.

CAPT Science Multiple-Choice Questions: *Carbon Cycle* (continued)

2. A teacher provides her class with a table displaying the relative greenhouse effect per molecule of different gases compared to carbon dioxide.

Carbon Dioxide	Methane	Nitrous Oxide	CFCs
1	30 times	160 times	17,000 times

Based on this table, a student made the conclusion that carbon dioxide is not the main cause of the greenhouse effect. What other data are needed to make a stronger conclusion?

a. data about the origin of the gases
b. data about the size of each type of molecule
c. data about the absorption of these gases by plants
d. data about the amount of each gas in the atmosphere✪

Strand III: Global Interdependence

Expected Performance: D INQ.2 Read, interpret and examine the credibility and validity of scientific claims in different sources of information.

CAPT Science Multiple-Choice Questions:
Potato Blight

Blight is a plant disease caused by a fungus that affects potato plants. Some wild breeds of potato have natural resistance to the fungus. These wild potatoes contain chemical compounds that cause them to taste bad. Scientists are trying to produce potato plants that are resistant to blight but still produce potatoes that taste good.

1. Which of the following describes an important difference between a potato plant cell and a human cell?

a. Plant cells have a cell wall, and animal cells do not.✪
b. Animal cells store water inside, and plant cells do not.
c. Plant cells have a cell nucleus, and animal cells do not.
d. Animal cells perform respiration, and plant cells do not.

Expected Performance: D 27. Describe significant similarities and differences in the basic structure of plant and animal cells.

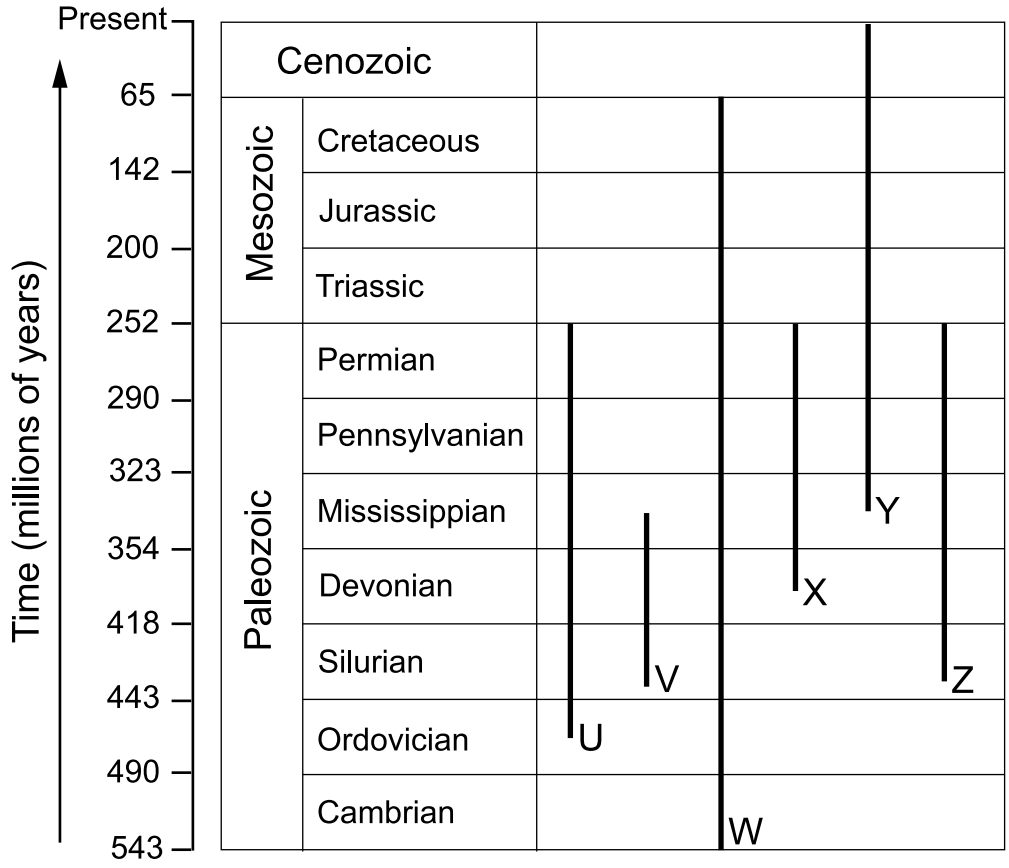
2. The development of a blight-resistant potato breed might be good for the environment because the new potato breed will need _____.

f. less water
g. less fertilizer
h. less fungicide✪
j. less field space

Expected Performance: D 35. Explain the risks and benefits of altering the genetic composition and cell products of existing organisms.

CAPT Science Multiple-Choice Questions:
Fossil Record

The diagram below shows the fossil record of different species.



1. When did a major extinction event **most likely** occur?

f. at the end of the Cenozoic
g. at the end of the Permian✪
h. at the beginning of the Silurian
j. at the beginning of the Cambrian

Strand V: Genetics, Evolution and Biodiversity

Expected Performance: D INQ.7 Assess the reliability of the data that was generated in the investigation.

CAPT Science Multiple-Choice Questions: *Fossil Record* (continued)

2. According to the records of fossil species V and W, which statement is **most likely** true?

a. Fossil species W appeared before fossil species V, allowing fossil species W to survive longer.
b. Fossil species W was ancestral to fossil species V because it appeared before fossil species V.
c. Fossil species W had greater genetic variability than fossil species V, allowing fossil species W to adapt and survive longer.✪
d. Fossil species W had lower reproductive success than fossil species V, allowing smaller populations to adapt and survive.

Strand V: Genetics, Evolution and Biodiversity

Expected Performance: D INQ.7 Assess the reliability of the data that was generated in the investigation.

3. The growth rate of a local population is dependent on the birth rate minus the death rate and _____.

f. the ratio of males to females in the population
g. the lifespan of females beyond the reproductive age
h. the amount of genetic variation that exists in the population
j. the immigration and emigration of individuals to and from the population✪

Expected Performance: D 44. Explain how change in population density is affected by emigration, immigration, birth rate and death rate, and relate these factors to the exponential growth of human populations.

4. Vestigial structures, such as hip bones in whales and appendixes in humans, are those that have little or no function for the organism. What is the **most likely** reason for this loss of function over time?

a. The organism is undergoing speciation.
b. The organism is experiencing genetic drift.
c. The structure was over utilized by the organism.
d. The structure was not highly beneficial to the organism.✪

Expected Performance: D 41. Explain how the current theory of evolution provides a scientific explanation for fossil records of ancient life forms.