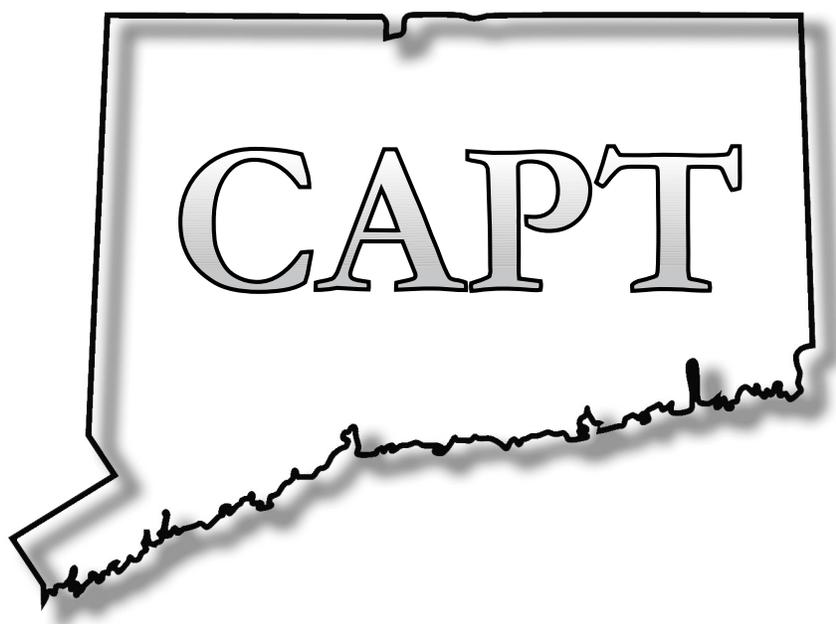


**CAPT Science
2008 Administration**



**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	
<i>How is scientific knowledge created and communicated?</i>	
Content Standards	Expected Performances
<p>SCIENTIFIC INQUIRY</p> <ul style="list-style-type: none"> ◆ 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. <p>SCIENTIFIC LITERACY</p> <ul style="list-style-type: none"> ◆ 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. <p>SCIENTIFIC NUMERACY</p> <ul style="list-style-type: none"> ◆ Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze, and present scientific data and ideas. 	<p>D INQ.1 Identify questions that can be answered through scientific investigation.</p> <p>D INQ.2 Read, interpret and examine the credibility and validity of scientific claims in different sources of information.</p> <p>D INQ.3 Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.</p> <p>D INQ.4 Design and conduct appropriate types of scientific investigations to answer different questions.</p> <p>D INQ.5 Identify independent and dependent variables, including those that are kept constant and those used as controls.</p> <p>D INQ.6 Use appropriate tools and techniques to make observations and gather data.</p> <p>D INQ.7 Assess the reliability of the data that was generated in the investigation.</p> <p>D INQ.8 Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.</p> <p>D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.</p> <p>D INQ.10 Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.</p>

Grade 9

Core Themes, Content Standards and Expected Performances

Strand I: Energy Transformations

Content Standards	Expected Performances
<p><i>Energy Transfer and Transformations – What is the role of energy in our world?</i></p> <p>9.1 - Energy cannot be created or destroyed; however, energy can be converted from one form to another.</p> <ul style="list-style-type: none"> ◆ Energy enters the Earth system primarily as solar radiation, is captured by materials and photosynthetic processes, and eventually is transformed into heat. 	<p>D 1. Describe the effects of adding energy to matter in terms of the motion of atoms and molecules, and the resulting phase changes.</p> <p>D 2. Explain how energy is transferred by conduction, convection and radiation.</p> <p>D 3. Describe energy transformations among heat, light, electricity and motion.</p>
<p><i>Energy Transfer and Transformations – What is the role of energy in our world?</i></p> <p>9.2 - The electrical force is a universal force that exists between any two charged objects.</p> <ul style="list-style-type: none"> ◆ 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. 	<p>D 4. Explain the relationship among voltage, current and resistance in a simple series circuit.</p> <p>D 5. Explain how electricity is used to produce heat and light in incandescent bulbs and heating elements.</p> <p>D 6. Describe the relationship between current and magnetism.</p>
<p><i>Science and Technology in Society – How do science and technology affect the quality of our lives?</i></p> <p>9.3 - Various sources of energy are used by humans and all have advantages and disadvantages.</p> <ul style="list-style-type: none"> ◆ 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. 	<p>D 7. Explain how heat is used to generate electricity.</p> <p>D 8. Describe the availability, current uses and environmental issues related to the use of fossil and nuclear fuels to produce electricity.</p> <p>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.</p>

Grade 9

Core Themes, Content Standards and Expected Performances

Strand II: Chemical Structures and Properties

Content Standards	Expected Performances
<p><i>Properties of Matter – How does the structure of matter affect the properties and uses of materials?</i></p> <p>9.4 - Atoms react with one another to form new molecules.</p> <ul style="list-style-type: none">◆ Atoms have a positively charged nucleus surrounded by negatively charged electrons.◆ The configuration of atoms and molecules determines the properties of the materials.	<p>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.</p> <p>D 11. Describe how atoms combine to form new substances by transferring electrons (ionic bonding) or sharing electrons (covalent bonding).</p> <p>D 12. Explain the chemical composition of acids and bases, and explain the change of pH in neutralization reactions.</p>
<p><i>Properties of Matter – How does the structure of matter affect the properties and uses of materials?</i></p> <p>9.5 – Due to its unique chemical structure, carbon forms many organic and inorganic compounds.</p> <ul style="list-style-type: none">◆ 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.	<p>D 13. Explain how the structure of the carbon atom affects the type of bonds it forms in organic and inorganic molecules.</p> <p>D 14. Describe combustion reactions of hydrocarbons and their resulting by-products.</p> <p>D 15. Explain the general formation and structure of carbon-based polymers, including synthetic polymers, such as polyethylene, and biopolymers, such as carbohydrate.</p>
<p><i>Science and Technology in Society – How do science and technology affect the quality of our lives?</i></p> <p>9.6 - Chemical technologies present both risks and benefits to the health and well-being of humans, plants and animals.</p> <ul style="list-style-type: none">◆ 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.	<p>D 16. Explain how simple chemical monomers can be combined to create linear, branched and/or cross-linked polymers.</p> <p>D 17. Explain how the chemical structure of polymers affects their physical properties.</p> <p>D 18. Explain the short- and long-term impacts of landfills and incineration of waste materials on the quality of the environment.</p>

Grade 9

Core Themes, Content Standards and Expected Performances

Strand III: Global Interdependence

Content Standards	Expected Performances
<p><i>The Changing Earth – How do materials cycle through the Earth’s systems?</i></p> <p>9.7 - Elements on Earth move among reservoirs in the solid earth, oceans, atmosphere and organisms as part of biogeochemical cycles.</p> <ul style="list-style-type: none"> ◆ 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. 	<p>D 19. Explain how chemical and physical processes cause carbon to cycle through the major earth reservoirs.</p> <p>D 20. Explain how solar energy causes water to cycle through the major earth reservoirs.</p> <p>D 21. Explain how internal energy of the Earth causes matter to cycle through the magma and the solid earth.</p>
<p><i>Science and Technology in Society – How do science and technology affect the quality of our lives?</i></p> <p>9.8 - The use of resources by human populations may affect the quality of the environment.</p> <ul style="list-style-type: none"> ◆ Emission of combustion by-products, such as SO₂, CO₂ and NO_x 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. 	<p>D 22. Explain how the release of sulfur dioxide (SO₂) into the atmosphere can form acid rain, and how acid rain affects water sources, organisms and human-made structures.</p> <p>D 23. Explain how the accumulation of carbon dioxide (CO₂) in the atmosphere increases Earth’s “greenhouse” effect and may cause climate changes.</p> <p>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.</p>
<p><i>Science and Technology in Society – How do science and technology affect the quality of our lives?</i></p> <p>9.9 - Some materials can be recycled, but others accumulate in the environment and may affect the balance of the Earth systems.</p> <ul style="list-style-type: none"> ◆ New technologies and changes in lifestyle can have positive and/or negative effects on the environment. 	<p>D 25. Explain how land development, transportation options and consumption of resources may affect the environment.</p> <p>D 26. Describe human efforts to reduce the consumption of raw materials and improve air and water quality.</p>

Grade 10

Core Themes, Content Standards and Expected Performances

Strand IV: Cell Chemistry and Biotechnology

Content Standards	Expected Performances
<p><i>Structure and Function – How are organisms structured to ensure efficiency and survival?</i></p> <p>10.1 - Fundamental life processes depend on the physical structure and the chemical activities of the cell.</p> <ul style="list-style-type: none"> ◆ 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. 	<p>D 27. Describe significant similarities and differences in the basic structure of plant and animal cells.</p> <p>D 28. Describe the general role of DNA and RNA in protein synthesis.</p> <p>D 29. Describe the general role of enzymes in metabolic cell processes.</p> <p>D 30. Explain the role of the cell membrane in supporting cell functions.</p>
<p><i>Science and Technology in Society – How do science and technology affect the quality of our lives?</i></p> <p>10.2 - Microorganisms have an essential role in life processes and cycles on Earth.</p> <ul style="list-style-type: none"> ◆ Understanding the growth and spread patterns of viruses and bacteria enables the development of methods to prevent and treat infectious diseases. 	<p>D 31. Describe the similarities and differences between bacteria and viruses.</p> <p>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.</p> <p>D 33. Explain how bacteria and yeasts are used to produce foods for human consumption.</p>
<p><i>Science and Technology in Society – How do science and technology affect the quality of our lives?</i></p> <p>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.</p> <ul style="list-style-type: none"> ◆ The principles of genetics and cellular chemistry can be used to produce new foods and medicines in biotechnological processes. 	<p>D 34. Describe, in general terms, how the genetic information of organisms can be altered to make them produce new materials.</p> <p>D 35. Explain the risks and benefits of altering the genetic composition and cell products of existing organisms.</p>

Grade 10

Core Themes, Content Standards and Expected Performances

Strand V: Genetics, Evolution and Biodiversity

Content Standards	Expected Performances
<p><i>Heredity and Evolution – What processes are responsible for life’s unity and diversity?</i></p> <p>10.4 - In sexually reproducing organisms, each offspring contains a mix of characteristics inherited from both parents.</p> <ul style="list-style-type: none"> ◆ 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. 	<p>D 36. Explain how meiosis contributes to the genetic variability of organisms.</p> <p>D 37. Use the Punnet Square technique to predict the distribution of traits in mono- and di-hybrid crossings.</p> <p>D 38. Deduce the probable mode of inheritance of traits (e.g., recessive/dominant, sex-linked) from pedigree diagrams showing phenotypes.</p> <p>D 39. Describe the difference between genetic disorders and infectious diseases.</p>
<p><i>Heredity and Evolution – What processes are responsible for life’s unity and diversity?</i></p> <p>10.5 - Evolution and biodiversity are the result of genetic changes that occur over time in constantly changing environments.</p> <ul style="list-style-type: none"> ◆ 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. 	<p>D 40. Explain how the processes of genetic mutation and natural selection are related to the evolution of species.</p> <p>D 41. Explain how the current theory of evolution provides a scientific explanation for fossil records of ancient life forms.</p> <p>D 42. Describe how structural and behavioral adaptations increase the chances for organisms to survive in their environments.</p>
<p><i>Science and Technology in Society – How do science and technology affect the quality of our lives?</i></p> <p>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.</p> <ul style="list-style-type: none"> ◆ 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. 	<p>D 43. Describe the factors that affect the carrying capacity of the environment.</p> <p>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.</p> <p>D 45. Explain how technological advances have affected the size and growth rate of human populations throughout history.</p>

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: *Genetically Modified Food*

Genetically Modified Food

Suppose a consumer reads the following news release regarding the safety of a genetically modified (GM) food product.

GM Grains Pose No Health Risk

Researchers report that genetically modified (GM) grains fed to test mice have no negative impact on health. In two trials, the offspring of mice fed GM grain for three weeks showed a similar survival rate as the offspring of mice that were fed non-GM grain. The trials have been called as a victory for GM food producers. A spokesperson for the research group stated that “it is highly unlikely for any unintended side effects to occur as a result of human consumption of GM grains.”

Provide three reasons a consumer should question the conclusions presented in this news release.

Write your answer in your answer booklet.

Rubric for *Genetically Modified Food*

Possible Correct Responses:

- No data are presented to back up the statement(s).
- “Similar survival rate” is vague; how similar was the survival rate?
- Survival is only one aspect of health; no other potential side-effects were mentioned (immune responses, tumor formation, etc.)
- The conclusions were based on a three-week study; what about long-term consumption of GM grains?
- There is no indication of who the researchers were affiliated with to determine whether they may have had an agenda/bias.
- Two trials are not sufficient to draw a definitive conclusion.
- Just because it does not affect mice does not mean it will not affect humans.
- Other acceptable questions.

3-Point Rubric:

Score 3

The response provides three reasons a consumer should question the conclusions presented in the news release.

Score 2

The response provides two reasons a consumer should question the conclusions presented in the news release.

Score 1

The response provides one reason a consumer should question the conclusions presented in the news release.

Score 0

The response describes little or no accurate or relevant information related to the credibility of the claims in the news release.

Strand V: Genetics, Evolution and Biodiversity

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

Scored Student Responses for *Genetically Modified Food*

Score 3

It's unlikely to get side effects but what
are the side effects that can occur. Also they
say that they fed mice GM and it was similar
to the Non-GM how similar & how not similar.
They fed mice but weren't mice.

This response provides three acceptable reasons that a consumer should question the conclusions presented in the news release: "It's unlikely to get side effects, but what are the side effects?"; "they fed mice GM and it was similar to the non-GM, how similar and how not similar?"; and "they fed mice, but we're not mice."

Scored Student Responses for Genetically Modified Food

Score 3

One reason a consumer should question the results is that the article never states who conducted the experiment. The "researchers" could work for a GM food producer and have a bias opinion that could affect results. Also, only two trials were conducted, not enough to draw a valid conclusion. Consumers should also question whether the effects of GM food on mice are directly comparable to humans. GM foods might have different effects on each.

This response provides three acceptable reasons that a consumer should question the conclusions presented in the news release: "the article never states who conducted the experiment. The researchers could work for a GM food producer and have a bias opinion that could affect results"; "only two trials were conducted, not enough to draw a valid conclusion"; and "question whether the effects of GM food on mice are directly comparable to humans...might have different effects on each."

Scored Student Responses for *Genetically Modified Food*

Score 2

1. They said similar survival rate not the same that's one?

2. What types of mice are they testing it on?

3. Why only three weeks why not more?

This response provides two acceptable reasons that a consumer should question the conclusions presented in the news release: "They said similar survival rate, not the same..." and "Why only three weeks, why not more?" The second question provided ("What types of mice are they testing it on?") is not relevant.

Scored Student Responses for *Genetically Modified Food*

Score 2

1. two trials is not enough to prove that it's not harmful
2. the mice need to be fed for more than three weeks because it may take more than three weeks for harmful effects to happen.

This response provides two acceptable reasons that a consumer should question the conclusions presented in the news release: "two trials is not enough to prove that it's not harmful" and "the mice need to be fed for more than three weeks because it may take more than three weeks for harmful effects to happen."

Scored Student Responses for *Genetically Modified Food*

Score 1

One reason could be it hasn't been tested on humans. The second reason could be are there antibiotics to fix this if they get sick and the third reason is if it can be fed to infants.

This response provides one acceptable reason that a consumer should question the conclusions presented in the news release: "...it hasn't been tested on humans." The other two questions are not relevant to the conclusions presented in the news release.

Scored Student Responses for *Genetically Modified Food*

Score 1

One reason is why did they choose grains
Another reason is how do they know
It won't have an effect on humans
Lastly is what will happen if it does.

This response provides one acceptable reason that a consumer should question the conclusions presented in the news release: "...how do they know it won't have an effect on humans" The first question ("why did they choose grains") is not relevant. The third question ("what will happen if it does") is too vague.

Scored Student Responses for *Genetically Modified Food*

Score 0

one because I think they need to ask questions about anything that is new. Especially if it is food. They should also ask questions because this food product is genetically modified. Meaning they had to experiment with it. Lastly because, you are taking chances when consuming any type of GM grain so why risk it?

This response does not provide any acceptable reason that a consumer should question the conclusions. The questions being asked are general and not focused on what is presented in the news release.

Scored Student Responses for *Genetically Modified Food*

Score 0

Three reasons a consumer should question the conclusions presented in this news release are, because GM food is not good, it makes people gain more weight, and because the GM mice should have a lower survival rate.

This response does not provide any acceptable reason that a consumer should question the conclusions presented in the news release. The student is giving his opinions about GM food.

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 applesauce into measuring cup, add 5 drops of enzyme A solution, and stir thoroughly.
3. Place a graduated cylinder under paper cone and add applesauce 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) What conclusion can be drawn from the students' experiment and results?
- b) Assess the reliability of the results of this investigation.

Write your answer in your answer booklet.

Rubric for *Enzymes*

Possible Correct Responses:

Conclusions:

- Enzyme A produces the most apple juice from applesauce.
- Enzyme B is not very effective at producing apple juice from applesauce.

Reliability:

- The results are reliable because the experimental design included a variable and a control.
- The results are reliable because the experiment was repeated once and similar results were obtained.
- The results should be questioned because only two trials were performed which is not sufficient data upon which to base a sound conclusion.

3-Point Rubric:

Score 3

The response draws a valid conclusion supported by the students' experimental results and explains why the results were or were not reliable.

Score 2

The response draws a valid conclusion supported by the students' experimental results and provides a general explanation for why the results were or were not reliable (they did the experiment twice).

-or-

The response explains in detail why the results were or were not reliable but fails to draw a valid conclusion supported by the students' experimental results.

Score 1

The response draws a valid conclusion supported by the students' experimental results. The response may also indicate that the results were or were not reliable but fails to provide an acceptable explanation.

-or-

The response indicates that the results were or were not reliable and provides a general explanation but fails to draw a valid conclusion supported by the students' experimental results.

Score 0

The response provides little or no accurate or relevant information.

Strand IV: Cell Chemistry and Biotechnology

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

Scored Student Responses for *Enzymes*

Score 3

Using this data, we can conclude that Enzyme solution A was very effective at producing apple juice from apple sauce, whereas Enzyme B did nearly nothing to produce apple juice, since it produced the same amount of liquid as plain old water did, about. This experiment was relatively reliable, since they took multiple trials and had a control, but they could have improved it by measuring the volume of the liquid in the graduated cylinder several different times throughout the experiment.

This response provides a valid conclusion ("enzyme solution A was very effective at producing apple juice from apple sauce") and specifically explains why the results are reliable ("they took multiple trials and had a control").

Scored Student Responses for *Enzymes*

Score 3

- a) From the students' experiment and results, I can conclude that Enzyme A solution produces the most juice when added to Apple sauce. I conclude this because Enzyme^A produced an average of 14.5 ml of juice, and the next highest was Enzyme B, which produced an average of 5.5 ml of juice. I can also conclude that Enzyme B solution and water were similar because they produced similar amounts of juice when added to the apple sauce.
- b) This investigation is somewhat reliable because the constants were very clear, but I could see many sources of error. Also, there were only 2 trials, which may not be enough to draw conclusions from.

This response provides a valid conclusion ("Enzyme A solution produces the most juice when added to apple sauce"), provides a general explanation of why the results are reliable ("the constants were very clear"), and provides a general explanation of why it may not be reliable ("there were only 2 trials").

Scored Student Responses for *Enzymes*

Score 2

A) From the students experiment and results you can conclude that Enzyme A produced the most apple juice. B) The reliability of these results are good because they have a clear procedure and more than one trial.

This response provides a valid conclusion ("Enzyme A produced the most apple juice") and provides a general explanation of why the results are reliable ("more than one trial").

Scored Student Responses for *Enzymes*

Score 2

a) Enzyme A solution produced the most amount of apple juice.

b) I think the reliability of the results are fairly acceptable. If there was at least one more trial done for each solution, I would consider it valid.

This response provides a valid conclusion ("Enzyme A solution produced the most amount of apple juice") and provides a general explanation of how the results could be more reliable ("at least one more trial done for each solution").

Scored Student Responses for *Enzymes*

Score 1

a) That enzyme solution A produced more juice than any of the 2 other solutions. I know this because trial 1 produced 14ml and trial 2 produced 15ml where the other only produced 6^{ml} & 6^{ml}.

b) The reliability of the result is not that good because we don't know what was in the solutions.

This response provides a valid conclusion ("enzyme solution A produced more juice than any of the 2 other solutions") but fails to provide an acceptable explanation for why the results aren't reliable.

Scored Student Responses for *Enzymes*

Score 1

① That enzyme A produces the most apple juice.

② It's reliable because anyone reading the directions can complete this experiment.

This response provides a valid conclusion ("enzyme A produces the most apple juice") but fails to provide an acceptable explanation for why the results are reliable.

Scored Student Responses for *Enzymes*

Score 0

well The conclusion is the more Drops in the cup the more water there will be. Also the less Drops you Put in the cups the less water that will be in the cup.

This response fails to provide either a valid conclusion or an acceptable explanation as to the reliability of the investigation.

Scored Student Responses for *Enzymes*

Score 0

A) These kids are trying to see how much juice is in apple sauce.

B) It will be hard to do over.

This response fails to provide either a valid conclusion or an acceptable explanation as to the reliability of the investigation. The conclusion ("trying to see how much juice is in applesauce") does not address the different enzyme solutions.

CAPT Science Open-Ended Item: *Acid Rain*

Acid Rain

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

Procedure:

1. Determine the mass of four different samples.
2. Pour vinegar in each of four separate, but identical, containers.
3. Place a sample of one material into one container and label. Repeat with remaining samples, placing a single sample into a single container.
4. After 24 hours, remove the samples from the containers and rinse each sample with distilled water.
5. Allow the samples to sit and dry for 30 minutes.
6. Determine the mass of each sample.

The students' data are recorded in the table below.

Sample	Starting Mass (g)	Ending Mass (g)	Difference in Mass (g)
Marble	9.8	9.4	-0.4
Limestone	10.4	9.1	-1.3
Wood	11.2	11.2	0.0
Plastic	7.2	7.1	-0.1

After reading the group's procedure, describe what additional information you would need in order to replicate the experiment. Make sure to include at least three pieces of information.

Write your answer in your answer booklet.

Rubric for *Acid Rain*

Possible Correct Responses:

Needed Information:

- You need to know how much vinegar was used in each container.
- You need to know what type of vinegar was used in each container.
- You need to know what materials to test.
- You need to know what size/surface area of materials should be used.
- You need to know how long each sample was rinsed in distilled water.
- You need to know what drying method to use.
- You need to know what size/type of container to use.
- Other acceptable responses.

3-Point Rubric:

Score 3

The response describes three additional pieces of information that would be needed to accurately replicate the experiment.

Score 2

The response describes two additional pieces of information that would be needed to accurately replicate the experiment.

Score 1

The response describes one additional piece of information that would be needed to accurately replicate the experiment.

Score 0

The response describes little or no accurate or relevant information from the acid rain investigation.

Strand III: Global Interdependence

Expected Performance: D INQ.4 Design and conduct appropriate types of scientific investigations to answer different questions.

Scored Student Responses for *Acid Rain*

Score 3

well, first of all if the chart wasn't there
I wouldn't know what the 4 samples were.
so they should have listed that. Also, it says
to put them in vinegar but it doesn't say
how much vinegar should be put in. It
also says to place them in a container but
it doesn't say what kind of container
and how big. It also doesn't tell us the
size of the samples

This response describes at least three additional pieces of information that would be needed to accurately replicate the experiment: "...what the four samples were...how much vinegar should be put in...what kind of container...and the size of the samples."

Scored Student Responses for *Acid Rain*

Score 3

In order to replicate the experiment, you would need additional information such as, how much vinegar was poured into each container. Additionally, you would need to know how large the containers were and how much/for how long the samples were rinsed with distilled water.

This response describes three additional pieces of information that would be needed to accurately replicate the experiment: "...how much vinegar was poured into each container...how large the containers were...and how long the samples were rinsed with distilled water."

Scored Student Responses for *Acid Rain*

Score 2

After reading the groups experiment, in order for me to replicate the experiment, the procedure would have to say exactly how much vinegar the group put into each container, also do we have to cover the containers after we place the samples into the vinegar. Without this crucial information, the whole procedure would have different results than if we were to have the correct information to conduct the experiment.

This response describes two additional pieces of information that would be needed to accurately replicate the experiment: "how much vinegar the group put in each container" and "do we have to cover the containers after we place the samples into the vinegar."

Scored Student Responses for *Acid Rain*

Score 2

To replicate the experiment, the students should of said what the samples were, how much vinegar to use, and what the vinegar was suppost to do to the marble, limestone, wood, and plastic.

This response describes two additional pieces of information that would be needed to accurately replicate the experiment: "what the samples were" and "how much vinegar to use."

Scored Student Responses for *Acid Rain*

Score 1

In order to replicate this experiment you will need to know how much vinegar to put into each container. You will need to know what to measure the mass with and you will also need to know why you are going to determine the mass of each of the four different samples.

This response describes one additional piece of information that would be needed to accurately replicate the experiment: "you will need to know how much vinegar to put into each container."

Scored Student Responses for *Acid Rain*

Score 1

The group would need to write in the experiment to measuring the mass with the vinegar. They would also need to describe how much vinegar is needed in the containers. Lastly you would want to know what the vinegar is supposed to do with the samples.

This response describes one additional piece of information that would be needed to accurately replicate the experiment: "describe how much vinegar is needed in the containers."

Scored Student Responses for *Acid Rain*

Score 0

They would have to add a conclusion and a hypothesis to their procedure.
In the data table they should have made observations over the 24 hour period.

This response describes no relevant piece of information that would be needed to accurately replicate the experiment.

Scored Student Responses for *Acid Rain*

Score 0

They should of use something different than vinegar also
(it should be longer the 24 hours. **LAST** of all,
they should've used different samples.

This response describes no relevant piece of information that would be needed to accurately replicate the experiment.

CAPT Science Open-Ended Item: *Solar Cooker Investigation*

Solar Cooker Investigation

A group of students has designed a solar cooker for an investigation. They are investigating whether the material that a container is made of has an effect on the rate of temperature change over time. They obtain three containers of identical size. They add water to each container. The containers are placed inside the solar cooker, which is made of a box lined with aluminum foil.

- a) Identify two additional pieces of equipment that the students will need to use in their investigation.
- b) Explain why each piece of equipment is necessary.

Write your answer in your answer booklet.

Rubric for *Solar Cooker Investigation*

Possible Correct Responses:

- Graduated cylinder: to accurately measure the water that must be added to the containers.
- Three identical thermometers: to be suspended in the containers so that water temperature can be measured.
- Timing device: to make sure the data for each container are collected within the same increments of time.
- Safety equipment: glove or cloth pad to handle the containers safely after heating or safety glasses to protect eyes from hot water that could splash.
- Lamp/light source/solar heat: to heat up the solar cooker.
- Meter stick: to measure the same level of water for each container.
- Other acceptable responses.

3-Point Rubric:

Score 3

The response identifies two pieces of equipment that the students would need in order to conduct their investigation and for each piece of equipment explains why it is necessary to the investigation.

Score 2

The response identifies two pieces of equipment that the students would need in order to conduct their investigation and for one piece explains why it is necessary to the investigation.

-or-

The response provides explanations for two pieces of equipment that are consistent with what is needed to conduct the investigation, but only identifies one piece of equipment or fails to identify either piece of equipment.

Score 1

The response identifies two pieces of equipment that the students would need in order to conduct their investigation, but fails to correctly explain why either piece of equipment is necessary.

-or-

The response identifies one piece of equipment that the students would need in order to conduct their investigation and explains why it is necessary to the investigation.

-or-

The student provides an explanation for a piece of equipment that is consistent with what is needed to conduct the investigation, but fails to identify the equipment.

Score 0

The response identifies one piece of equipment that the students would need in order to conduct their investigation but fails to explain why it is necessary to the investigation.

-or-

The response describes little or no accurate or relevant information related to the solar cooker investigation.

Strand I: Energy Transformation

Expected Performance: D INQ.6 Use appropriate tools and techniques to make observations and gather data.

Scored Student Responses for Solar Cooker Investigation

Score 3

TWO other pieces of equipment that the students will need to use is a thermometer and a clock or stopwatch. In order to have a controlled experiment the students will need to take the temperature of the water in the containers before placing them in the solar cooker and then again after being in the solar cooker. A stopwatch or clock is necessary because the students will need to time how long the containers are in the cooker.

This response identifies two acceptable pieces of equipment that the students would need in order to conduct their investigation and explains why each piece is necessary: "thermometer...to take the temperature of the water in the containers before placing them in the solar cooker and then again after being in the solar cooker" and "a stopwatch or clock is necessary because the students will need to time how long the containers are in the cooker."

Scored Student Responses for Solar Cooker Investigation

Score 3

A. A timer, a thermometer

B. timer to keep track of how long it is being cooked for, a thermometer to see the rate of temp. over time.

This response identifies two acceptable pieces of equipment that the students would need in order to conduct their investigation and explains why each piece is necessary: "timer to keep track of how long it is being cooked for" and "a thermometer to see the rate of temperature over time."

Scored Student Responses for Solar Cooker Investigation

Score 2

a) They didn't add there heat source such as a heat lamp. And they also forgot about the thermometer.

b) The heat lamp is important because you need a heat source to get good realistic results. And the thermometer is important because you need that to show you results.

This response identifies two acceptable pieces of equipment that the students would need in order to conduct their investigation and provides a sufficient explanation for only one of the pieces: "heat lamp because you need a heat source" and "thermometer." The explanation for thermometer ("because you need that to show your results") is too vague.

Scored Student Responses for Solar Cooker Investigation

Score 2

The students will need a measurement of the amount of water they place in the containers or else they will have varied results. The biggest thing the students need is a thermometer. This is the most important because they will need it to measure the temperature of the water after being in the solar cooker.

This response provides two sufficient explanations for pieces of equipment but only identifies one of them: "the students will need a measurement of the amount of water they place in the containers" and "a thermometer...to measure the temperature of the water after being in the solar cooker."

Scored Student Responses for Solar Cooker Investigation

Score 1

2 important additional pieces of equipment that they should've used is a lid, to secure air in to its hottest temperature, and a thermometer, to check and compare and contrast the temperatures.

This response identifies one acceptable piece of equipment that the students would need in order to conduct their investigation and explains why it is necessary: "a thermometer to check and compare and contrast the temperatures." A lid is not necessary for this experiment.

Scored Student Responses for Solar Cooker Investigation

Score 1

A.) Two additional pieces of equipment that the students need to use in their investigation are a light and Aluminum Foil.

B.) The light is needed as a heat source because if there isn't a heat source, the water will stay the same temperature. The Aluminum Foil is needed because it will trap the heat inside of the solar cooker.

This response identifies one acceptable piece of equipment that the students would need in order to conduct their investigation and explains why it is necessary: "the light is needed as a heat source because if there isn't a heat source, the water will stay the same temperature."

Scored Student Responses for Solar Cooker Investigation

Score 0

An item they wish to cook, as a control, something to record data on. Recording data tells you what went on during the experiment. The control lets you know how much it changed from normal.

This response fails to identify an acceptable piece of equipment that the students would need in order to conduct their investigation.

Scored Student Responses for Solar Cooker Investigation

Score 0

A well they going to need pen
and paper to write there prediction,
result, and materials

B well because they all play a
major part in the investigation.

This response fails to identify an acceptable piece of equipment that the students would need in order to conduct their investigation.

CAPT Science Open-Ended Item: *Polymer Investigation*

Polymer Investigation

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

Procedure:

1. Tightly wrap a sample of kitchen wrap from manufacturer A over the top of a coffee can.
2. Place a 10-gram weight on the kitchen wrap to see if it breaks.
3. Continue to add 10-gram weights one at a time until the kitchen wrap breaks and the weights fall into the can.
4. Record the number of 10-gram weights the kitchen wrap held before breaking.
5. Repeat the procedure exactly for a sample of kitchen wrap from manufacturer B.
6. Repeat the procedure exactly for a sample of kitchen wrap from manufacturer C.

- a) What question were the students attempting to answer with this investigation?
- b) Identify the independent variable and the dependent variable in the group's investigation.

Write your answer in your answer booklet.

Rubric for *Polymer Investigation*

Possible Correct Responses:

Possible Question:

- Which type of kitchen wrap is the strongest?
- Is there a difference in strength between different kitchen wraps?
- Which kitchen wrap can hold the most weight?
- Other acceptable responses.

Variables:

The independent variable is the type of kitchen wrap used and the dependent variable is the amount of weight the kitchen wrap can hold without breaking.

3-Point Rubric:

Score 3

The response provides a scientifically valid question that could be answered using this procedure and identifies the independent and dependent variables.

Score 2

The response provides a scientifically valid question that could be answered using this procedure, identifies the independent variable, but fails to identify the dependent variable.

-or-

The response provides a scientifically valid question that could be answered using this procedure, fails to identify the independent variable, but correctly identifies the dependent variable.

-or-

The response fails to provide a scientifically valid question that could be answered using this procedure, but correctly identifies the independent and dependent variables.

Score 1

The response provides a scientifically valid question that could be answered using this procedure, but fails to identify the independent and dependent variables.

-or-

The response fails to provide a scientifically valid question that could be answered using this procedure, correctly identifies the independent variable, but fails to identify the dependent variable.

-or-

The response fails to provide a scientifically valid question that could be answered using this procedure, fails to identify the independent variable, but correctly identifies the dependent variable.

Score 0

The response provides little or no accurate or relevant information related to the polymer investigation.

Strand II: Chemical Structures and Properties

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 *Polymer Investigation*

Score 3

a) Which kitchen wrap can hold the most weight.

b) Independent variable - the different kitchen wraps

Dependent variable - how much weight each wrap can hold.

This response provides a scientifically valid question ("which kitchen wrap can hold the most weight") and correctly identifies the independent variable ("the different kitchen wraps") and the dependent variable ("the amount of weight each wrap can hold").

Scored Student Responses for *Polymer Investigation*

Score 3

The students wanted to determine which type of kitchen wrap will be the strongest or could hold the most weight.

The independent variables in this experiment are the types of kitchen wraps. The dependent variable is the weight, in grams, that the kitchen wrap could hold before breaking.

This response provides a scientifically valid question (“which type of kitchen wrap will be the strongest or could hold the most weight”) and correctly identifies the independent variable (“the types of kitchen wrap”) and the dependent variable (“the weight, in grams, that the kitchen wrap could hold before breaking”).

Scored Student Responses for *Polymer Investigation*

Score 2

a. What kitchen wrap can hold
the most weight?

b. The independent variable is the
kitchen wrap.
The dependent is the 10 grams
weights.

This response provides a scientifically valid question ("what kitchen wrap can hold the most weight") and correctly identifies the independent variable ("the kitchen wrap") but fails to correctly identify the dependent variable. The *amount* of 10-gram weights is the dependent variable, not "the 10-gram weights."

Scored Student Responses for *Polymer Investigation*

Score 2

a) The question probably was, how many 10-gram weights can kitchen wrap A, B and C hold?

b) The independent variable is the kitchen wrap.
The dependent variable is the 10-gram weight

This response provides a scientifically valid question (“how many 10-gram weights can kitchen wrap A, B, and C hold”) and correctly identifies the independent variable (“the kitchen wrap”) but fails to correctly identify the dependent variable. The *amount* of 10-gram weights is the dependent variable, not “the 10-gram weight.”

Scored Student Responses for *Polymer Investigation*

Score 1

A.) The student's question was that they were trying to find out what manufacturer had the strongest kitchen wrap.

B.) The independent variable is the 10 gram weights. While the dependent variable is the different manufacturers.

This response provides a scientifically valid question ("what manufacturer had the strongest kitchen wrap") but fails to correctly identify the independent variable or the dependent variable.

Scored Student Responses for *Polymer Investigation*

Score 1

a.) The question they are trying to answer is which
kitchen wrap will hold the most weight:
Manufacturer A, B or C.

b.) ind: coffee in cup
dep: kitchen wrap

This response provides a scientifically valid question ("which kitchen wrap will hold the most weight: Manufacturer A, B, or C") but fails to correctly identify the independent variable or the dependent variable.

Scored Student Responses for *Polymer Investigation*

Score 0

a) What was the weight in the end.
b)

This response fails to provide a scientifically valid question and fails to correctly identify the independent variable or the dependent variable.

Scored Student Responses for *Polymer Investigation*

Score 0

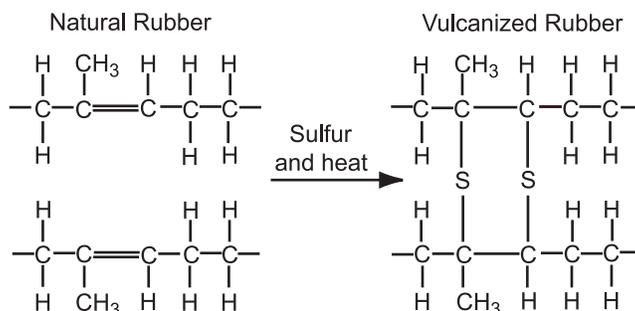
The student's question to answer with this investigation is
how many 10-grams of weights can kitchen wrap hold.
The independent variable is the weights and the
dependent variable is kitchen wrap.

This response fails to provide a scientifically valid question ("how many 10-grams of weights can kitchen wrap hold" does not attempt to compare the different kitchen wraps) and fails to correctly identify the independent variable or the dependent variable.

CAPT Science Multiple-Choice Questions: *Rubber Tires*

The tires on most cars are not made of natural rubber because it becomes brittle in the cold and sticky in the heat. Instead, natural rubber is vulcanized by adding sulfur and heat, making it stronger and more elastic. This process is represented chemically in the diagram below.

Vulcanization Process



1. During the vulcanization reaction shown above, the natural rubber polymer is converted to a new polymer by the _____.
 - a. cross-linking of carbon atoms with sulfur atoms Ⓢ
 - b. cross-linking of hydrogen atoms with sulfur atoms
 - c. replacement of carbon atoms with sulfur atoms
 - d. replacement of hydrogen atoms with sulfur atoms

Strand II: Chemical Structures and Properties

Expected Performance: D 16. Explain how simple chemical monomers can be combined to create linear, branched and/or cross-linked polymers.

2. The complete combustion or burning of **natural rubber** will produce _____.
 - f. hydrogen and oxygen
 - g. oxygen and water
 - h. hydrogen gas and water
 - j. carbon dioxide and water Ⓢ

Strand II: Chemical Structures and Properties

Expected Performance: D 14. Describe combustion reactions of hydrocarbons and their resulting by-products.

CAPT Science Multiple-Choice Questions: *Rubber Tires (continued)*

3. The following data are recorded during a supervised investigation.

Experimental Data

Type of Container	Total Burning Time (min.)	Amount of Fuel at Start (grams)	Amount of Fuel Remaining (grams)
Closed	5	100	73
Open	12	100	0

What question was the investigator **most likely** trying to answer?

- a. How does the presence of oxygen affect combustion?ⓧ
- b. At what point is equilibrium reached in a combustion reaction?
- c. What are the byproducts of an incomplete combustion reaction?
- d. Does the amount of fuel in a combustion reaction affect the burn time?

Strand II: Chemical Structures and Properties

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

CAPT Science Multiple-Choice Questions: *Plant Cells*

Plants, like all other organisms, are composed of cells.

1. A group of students placed spinach leaves in a beaker of water in full sunlight. After several hours, small bubbles appeared on the leaves. These bubbles probably consisted of _____.
- a. H_2O
 - b. O_2 Ⓢ
 - c. CO_2
 - d. H_2

Strand IV: Cell Chemistry and Biotechnology

Expected Performance: D 30. Explain the role of the cell membrane in supporting cell functions.

2. Generally, plants that grow in the shade have larger leaves in comparison to plants that grow in full sun. The advantage of having larger leaves in a shaded environment is _____.
- f. an increase in water supply
 - g. an increase in light absorption Ⓢ
 - h. a decrease in water loss
 - j. a decrease in heat production

Strand IV: Cell Chemistry and Biotechnology

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

CAPT Science Multiple-Choice Questions: *Plant Cells (continued)*

3. Students are exploring what happens to potatoes when placed in liquid. They cut one potato into slices and placed the slices in 3 different solutions, as described in the table below.

Solution	Amount of Solute (in grams)	Initial Mass of Potato (in grams)	Mass of Potato after 25 Minutes (in grams)
100 cc distilled water	0	10	12
100 cc saltwater A	7	10	10
100 cc saltwater B	25	10	8

Which of the following is the independent variable in the students' experiment?

- a. the amount of time in the solution
- b. the shape of the slices
- c. the mass of the potatoes
- d. the concentration of the solutions

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.

CAPT Science Multiple-Choice Questions: *Power Plants*

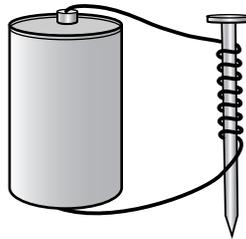
A power company is building a new power plant to provide electricity for several communities.

1. What is a major advantage of using wind energy instead of coal or nuclear power plants?
 - f. Wind is a renewable energy source. ⓧ
 - g. Wind is consistently available in all locations.
 - h. Windmills reduce the strength of severe storms.
 - j. A single windmill produces more energy than a nuclear plant.

Strand I: Energy Transformations

Expected Performance: 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.

A group of students was studying simple electromagnets. They carried out the following experiment.



1. Take a nail and wrap a 10-cm wire around the nail five times.
2. Connect both ends of the wire to a 1.5-volt battery.
3. Measure how many paper clips can be lifted by the end of the nail.
4. Repeat for three trials.
5. Repeat steps 1–4 using the same wire and increasing the number of loops of wire around the nail by five.

Number of Loops of Wire	Number of Paper Clips Lifted			
	Trial 1	Trial 2	Trial 3	Average
5	4	2	3	3.0
10	4	5	5	4.7
15	7	5	6	6.0

2. Which of the following would **most** improve the design of the experiment?
 - a. Replace the nail with a wood pencil.
 - b. Increase the length of the wire as the number of loops is increased.
 - c. Keep the number of paper clips lifted constant in the experiment.
 - d. Increase the number of loops of wire beyond fifteen. ⓧ

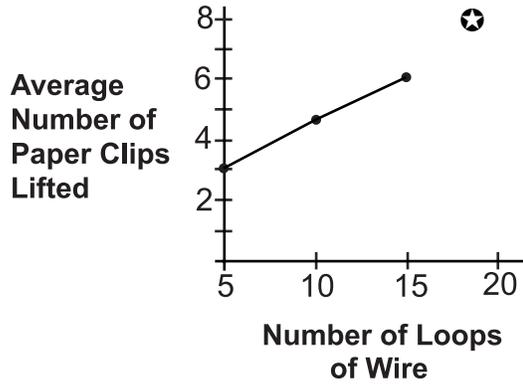
Strand I: Energy Transformations

Expected Performance: D INQ.4 Design and conduct appropriate types of scientific investigations to answer different questions.

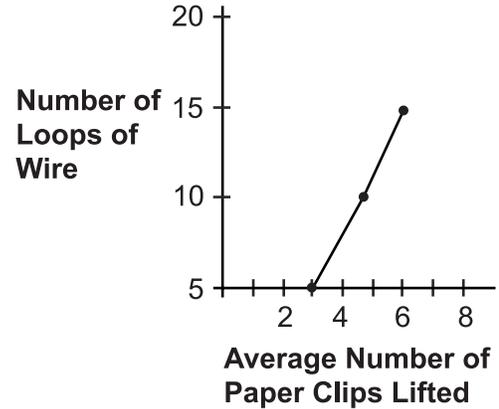
CAPT Science Multiple-Choice Questions: Power Plants (continued)

3. Which graph correctly displays the results of the experiment?

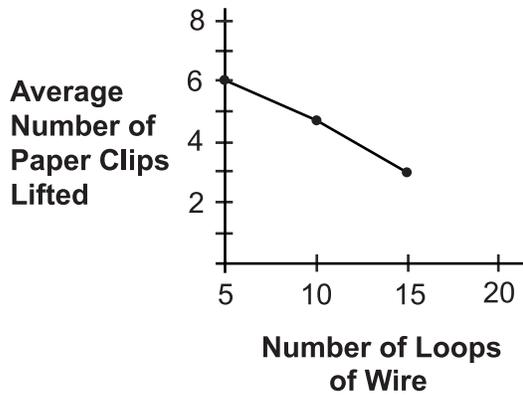
f.



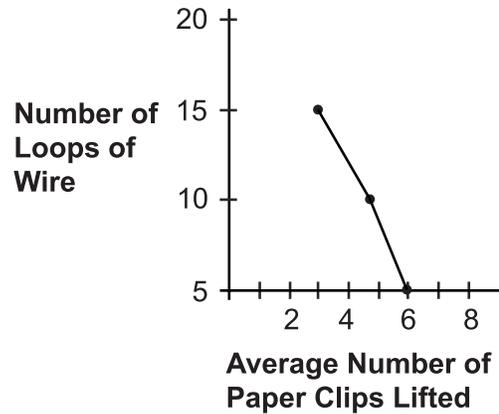
g.



h.



j.



Strand I: Energy Transformations

Expected Performance: D INQ.8 Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.

CAPT Science Multiple-Choice Questions: *Pollution*

Pollution has many causes and can affect air and water quality in a variety of ways.

1. The burning of fossil fuels may contribute to an increase in global temperatures. What might lead to this increase in temperature?
 - a. The combustion products reflect solar radiation away from Earth.
 - b. Carbon dioxide in the atmosphere attracts solar radiation.
 - c. Carbon dioxide in the atmosphere blocks energy from escaping into space. ⚡
 - d. The combustion products allow more energy to enter the earth.

Strand III: Global Interdependence

Expected Performance: D 23. Explain how the accumulation of carbon dioxide (CO₂) in the atmosphere increases Earth's "greenhouse" effect and may cause climate changes.

2. Which of the following is directly responsible for acid rain?
 - f. steam vented from a nuclear power plant
 - g. sulfur dioxide released from a coal-fired power plant ⚡
 - h. mining of coal for a coal-fired power plant
 - j. processing of uranium for a nuclear power plant

Strand III: Global Interdependence

Expected Performance: D 22. Explain how the release of sulfur dioxide (SO₂) into the atmosphere can form acid rain, and how acid rain affects water sources, organisms and human-made structures.

3. A student wanted to design an experiment to determine the effect of nitrates on algae growth. Which procedure would create the **most** valid results?
 - a. Vary both the temperature and the amount of nitrates.
 - b. Keep the temperature constant and vary the amount of nitrates. ⚡
 - c. Vary the temperature and keep the amount of nitrates constant.
 - d. Keep both the temperature and the amount of nitrates constant.

Strand III: Global Interdependence

Expected Performance: D INQ.4 Design and conduct appropriate types of scientific investigations to answer different questions.

CAPT Science Multiple-Choice Questions: *Illnesses*

The common cold is caused by a virus that enters the human body and causes mild, flu-like symptoms. Some people believe that the common cold can be treated by digesting the herb Echinacea. The following table shows results from a study conducted to explore the effects of Echinacea on children with colds.

Echinacea Study

Type of Treatment	A Pill Containing Echinacea	Same Type of Pill Without Echinacea
Number of children taking pills	337	370
Average length of cold infection (days)	10	10
Children having more than one cold during the study	52%	64%
Children developing a skin rash	7.1%	2.7%

1. Data in the table show that the use of Echinacea can _____.
- f. reduce the length of cold infection from 10 to 7 days
 - g. increase the incidence of colds in children from 52% to 64%
 - h. increase the percent of children with skin rash from 2.7% to 7.1% 
 - j. reduce the numbers of children having colds from 370 to 337 cases

Strand V: Genetics, Evolution and Biodiversity

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: *Illnesses (continued)*

2. A possible conclusion from the data is that Echinacea _____.
- a. is a safe remedy for the common cold
 - b. is effective only for children
 - c. has side effects✱
 - d. reduces the length of colds

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.

3. It is very difficult to develop a vaccine against the common cold. The reason for this is that the common cold virus _____.
- f. hides in the digestive system
 - g. changes rapidly due to high mutation rates✱
 - h. includes RNA as its genetic materials
 - j. is too small for the immune system to detect

Strand V: Genetics, Evolution and Biodiversity

Expected Performance: D 40. Explain how the processes of genetic mutation and natural selection are related to the evolution of species.