Fall 2001

DELAWARE

STUDENT TESTING PROGRAM

ITEM SAMPLER

AN ANALYSIS OF ELEMENTARY SCHOOL DSTP SCIENCE ITEMS

Delaware Department of Education

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Harcourt Educational Measurement
A Harcourt Assessment Company

SCIENCE

The purpose of this sampler is to provide Delaware teachers and educators with information about the science test administered in the 4th and 6th grades. It contains examples of questions that represent the range of difficulty and type of item that appear on the science portion of the Delaware Student Testing Program (DSTP).

Items on the Science portion of the DSTP:

- Measure all eight (8) content standards:

  Nature and Application of Science and Technology
  Materials and Their Properties
  Energy and Its Effects
  Earth in Space
  Earth's Dynamic Systems
  Life Processes
  Diversity and Continuity of Living Things
  Ecology

- Measure the standard at the grade cluster level

ITEM TYPES

The science test includes 32 multiple choice items, which are scored on a scaled point range of 0-1, and 18 short answer (constructed response) items, which are scored on a scale point range of 0-2.

The science test assesses scientific capabilities, knowledge and understanding. Students are asked to interpret or create charts, graphs, tables, and simple diagrams or other visual representations. In some instances, students are asked to group, sort, and classify objects or organisms based on similarities or physical properties. In other instances, they are asked to provide or identify evidence, interpret a simple model, describe or identify an event or sequence of events, draw conclusions from data, and generate an explanation. One-word responses do not constitute a full explanation. Students who produce incomplete descriptions or vague explanations do not receive full credit for their responses. Appropriate vocabulary, while desirable, is not essential provided that students show conceptual understanding in their written response. Every item on the test is coded to the Delaware science content standards. All items have been written and edited by Delaware teachers and educators and have been approved by a Bias Committee and Science Content Advisory Committee.

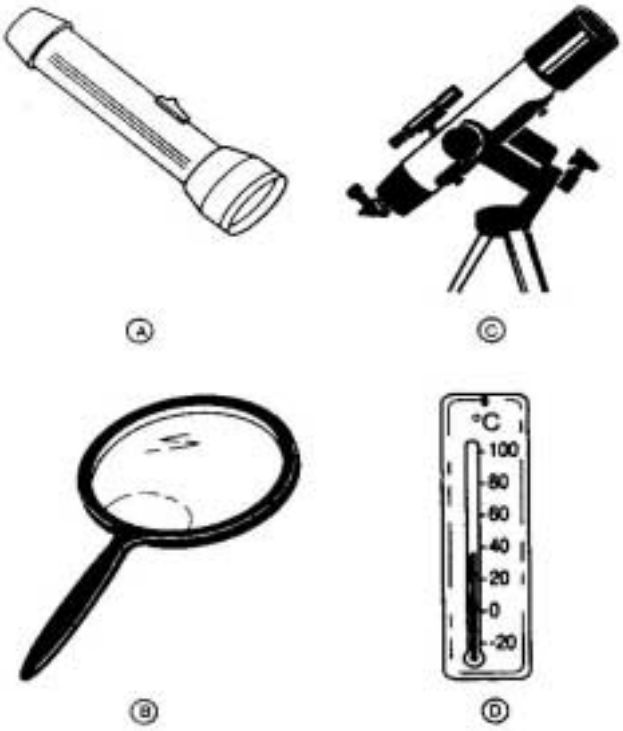
SAMPLE ITEMS

The following sample items either appeared on a state test or are a part of the item bank. Analysis of item statistics for some of the questions suggests areas where students seem to perform very well and areas where students' performance could be improved.

K-3 GRADE CLUSTER

One area of strength among all elementary students is their ability to select an appropriate tool for collecting data (Standard 1, The Nature and Application of Science and Technology, Science as Inquiry). For example, 96% of Delaware's students can correctly select the telescope as an instrument that is used to observe stars, as seen in the sample item below.

Which of these tools do scientists use to look at the stars?



However, when students were asked to identify what object is at the center of our solar system, only 61% of the students could choose B—The Sun— as the correct response (Standard 4, Earth in Space, Solar System Models). This may suggest that students need more opportunities to work with physical models, when appropriate. Using scale-sized spherical objects placed at different distances to model the Solar System is one example teachers could use in the classroom.

What object is at the center of our solar system?

A. The North Star

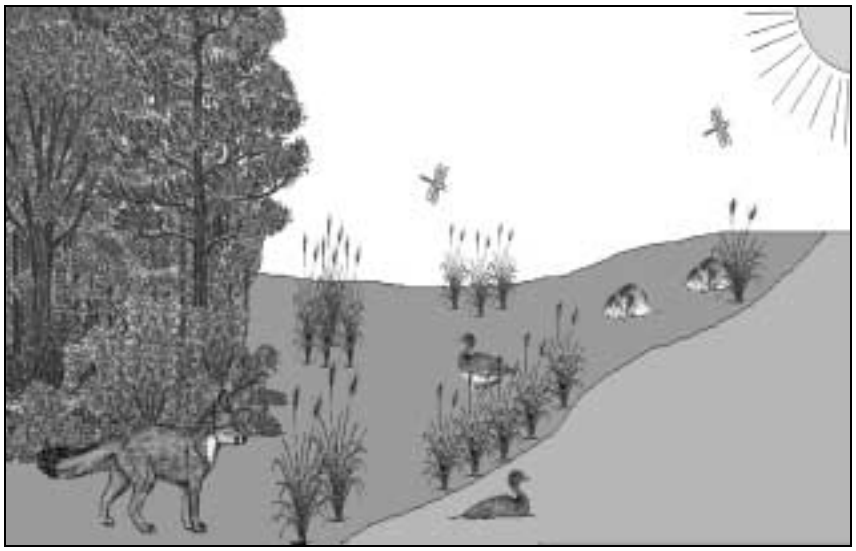
B. The Sun

C. Earth

D. The Moon

Most elementary students were very successful with classification questions, such as grouping various objects or organisms into living versus non-living categories. However, when asked to explain the ways the living things depend on non-living things, they had much more difficulty. Below is a sample of an item that represents the kind of question that challenged students to consider how living things interact with non-living things (Standard 8, Ecology, Interactions Within the World Around Us). While this item has not appeared on an actual test, it is very similar to ones that do. [The artwork below is an example of a scene that Harcourt Educational Measurement would modify. Students write their responses in the test booklet in the space provided.]

All organisms need certain things to survive. A fox can survive at the edge of the woods near a field. What are two reasons that the fox can survive in this habitat?



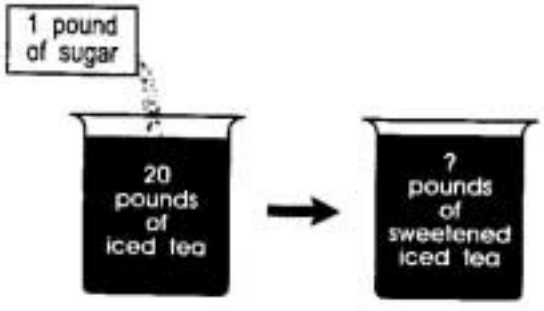
Scoring Tool:

2 Points: Response indicates two correct reasons that a fox can survive in this habitat, e.g., the woods provide shelter, the small animals in the field provide food, the woods provide a den for raising the young, the stream provides water, OR any other scientifically accurate response.

1 Point: Partially correct, e.g., response provides only one correct reason or way the fox can survive in this habitat.

0 Points: Incorrect, inappropriate, or incomplete response.

One concept that appears to be problematic for students is conservation of matter. Most understand that when substances are combined, the total mass will increase. The sample item below measures student understanding of this concept (Standard 2, Materials & Their Properties, Mixtures & Solutions) and is similar to the kind of item a student encounters on the DSTP.



Bea is making iced tea for a party. The iced tea weighs 20 pounds. She adds 1 pound of sugar to the iced tea and stirs it until the sugar dissolves. The sweetened iced tea will weigh—

A. 19 pounds

B. 20 pounds

C. 21 pounds

D. You cannot tell how much it will weigh.

Answer: C

However, when asked about the total mass of a substance or object after it underwent a physical change (that is, a change in its shape or number of parts), students had difficulty realizing that the total amount of matter is conserved (Standard 2, Materials & Their Properties, Changes in Materials). See the example below.

Jeremy placed an apple on a scale as shown above. He found that the apple weighed 300 grams. He carefully cut the apple into small pieces and placed them back on the scale. Which of the following is true?

A. The pieces will weigh more than the whole apple.

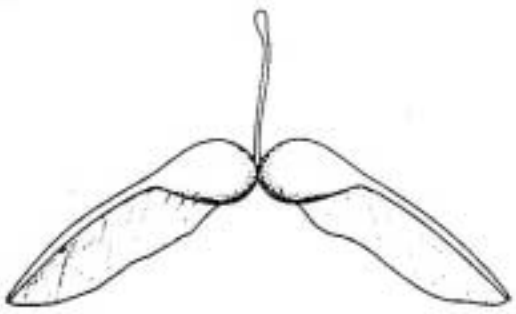
B. The pieces will weigh less than the whole apple.

C. The pieces will weigh the same as the whole apple.

D. The pieces' weight cannot be predicted.

Answer: C

Another area where student performance was varied occurred in the context of structure/function questions. The majority of students (72%) were able to answer a structure/function question correctly when it dealt with a single organism isolated from its environment, as seen in the sample item below (Standard 6, Life Processes, Structure/Function Relationship). Success on this kind of structure/function question was similar for both multiple choice and short answer formats.



Some plant seeds are designed so that they are easily carried away from the parent. How could the structure of this maple seed help it to be moved away from the parent tree?

A. It could be eaten by animals.

B. It could fall to the ground quickly.

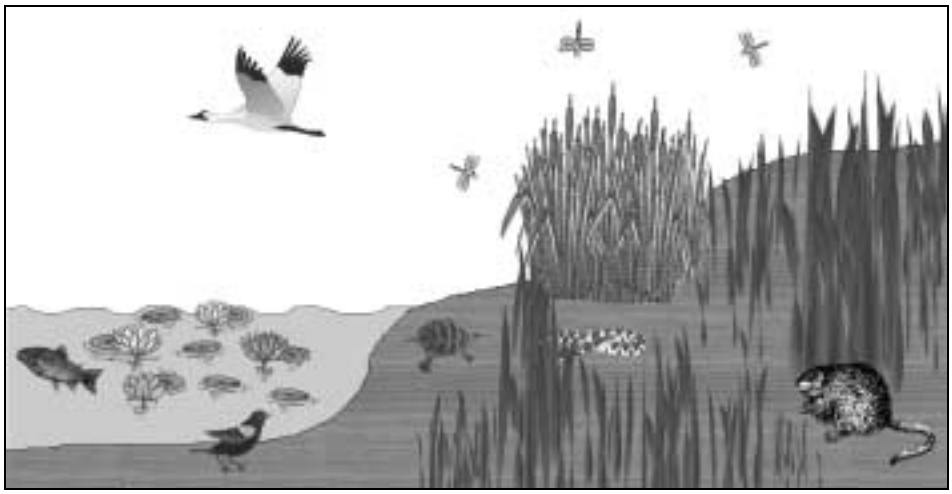
C. It could stick to an animal's fur.

D. It could be carried by the wind.

Answer: D

However, it is puzzling to explain why students had such difficulty in identifying a feature (or structure) that helps an organism survive in its natural habitat, even when the question includes a graphic that provides information about the organism's habitat (Standard 8, Ecology, Changes in Environment). See below an example of this kind of item. While this item has not appeared on an actual test, it is very similar to ones that do. (The artwork below is an example of a scene that Harcourt Educational Measurement would modify.)

Choose two consumers in the marsh scene below. For each consumer, pick one of its features and explain how that feature helps it survive in this habitat. You may copy the chart below into your response booklet to help you answer the question.



Consumer	Feature	How This Feature Helps It Survive
1.		
2.		

Scoring Tool:

2 Points: Response includes two consumers and explains how one feature or structure for each consumer helps it to survive in this habitat, e.g., muskrat has fur for warmth when getting food in water; the turtle has a shell for protection from predators; the bird has a beak that helps it catch insects, OR any other scientifically accurate response.

1 Point: Partially correct, e.g., identifies one consumer, one feature, and how this feature helps it survive in this habitat.

0 Points: Incorrect, inappropriate, or incomplete response.