1. Explain how you can find out the volume of a solid object, such as a small rock, using only water and either a measuring cup or a graduated cylinder.
### Scoring Guide

<table>
<thead>
<tr>
<th>Score &amp; Description</th>
<th>Complete</th>
<th>Partial</th>
<th>Unsatisfactory/Incorrect</th>
</tr>
</thead>
</table>
| **Complete**        | Student correctly describes how to determine the volume of a solid object using water and a measuring cup or graduated cylinder. Comparison or change in volume of water should be explicit. Method A:  
  a. Pour some water into the graduated cylinder  
  b. Record the water level  
  c. Then put the rock in the graduated cylinder  
  d. Record the water level again  
  e. The difference between the first and second volume measurements is the volume of the rock  
  Method B:  
  Spillage Responses = Fill cup (to the top), add rock, catch the water that overflows in separate container, and measure the overflow. Overflow = volume of the rock. | Student gives the first four of the steps involved in measuring the volume of a solid object, but does not compare the change in water level or mentions three or fewer of the steps but does discuss the change in water level. Method A:  
  Procedure (steps a-d above) or volume calculation (step e)  
  OR  
  Method B:  
  Procedure, including measuring the overflow or stating the overflow equals the volume of the rock | Student demonstrates no understanding of how to use water and a graduated cylinder to measure volume. |

### Complete - Student Response

1. Explain how you can find out the volume of a solid object, such as a small rock, using only water and either a measuring cup or a graduated cylinder.
1 Explain how you can find out the volume of a solid object, such as a small rock, using only water and either a measuring cup or a graduated cylinder.

Fill the cylinder with water until the top. It would then drop in the rock. Water would flow out. Then I would pour out the water into another cylinder. Without the rock, then I’d see how much water is missing and measure it.

Scorer Comments:
The first response describes a complete displacement method (method A) for measuring the volume of a solid object. The second response describes an overflow method (method B).

Partial - Student Response
1 Explain how you can find out the volume of a solid object, such as a small rock, using only water and either a measuring cup or a graduated cylinder.
First you measure the water in the cylinder. Then you add. Find out how much has been raised. Subtract the increase from the original level. The volume of the object is then your final answer.

Scorer Comments:
The first response describes a correct method, but the subtraction of volume readings is incorrect. The second response provides an incomplete method, but correctly recognizes that the amount of water displaced is the volume of the object.

Unsatisfactory/Incorrect - Student Response
1 Explain how you can find out the volume of a solid object, such as a small rock, using only water and either a measuring cup or a graduated cylinder.

You can use a measuring cup and water to find the volume of a small rock. You can fill the measuring cup with water and put the rock into it. By knowing how much water was in the cup before the rock was put in, you can find the volume of the rock.
1 Explain how you can find out the volume of a solid object, such as a small rock, using only water and either a measuring cup or a graduated cylinder.

OBSERVE IF IT SINKS OR FLOATS IN CUP OF WATER.

Scorer Comments: The first response describes only an incomplete method (steps a-c), and the second response makes only an incorrect statement.
### 2005 National Performance Results

<table>
<thead>
<tr>
<th>Score</th>
<th>Percentage of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsatisfactory/incorrect</td>
<td>45%</td>
</tr>
<tr>
<td>Partial</td>
<td>27%</td>
</tr>
<tr>
<td>Complete</td>
<td>17%</td>
</tr>
<tr>
<td>Omitted</td>
<td>9%</td>
</tr>
<tr>
<td>Off task</td>
<td>3%</td>
</tr>
</tbody>
</table>

Note:
- These results are for public and nonpublic school students.
- Percentages may not add to 100 due to rounding.

**The Fields of Science:** Physical Sciences (Sub content classification: Matter and Its Transformations)
**Knowing and Doing Science:** Scientific Investigation
The Fields of Science

Physical Sciences

This question measures basic knowledge and understanding of the following:

Knowing and Doing Science

Scientific Investigation

Scientific investigation probes students’ abilities to use the tools of science, including both cognitive and laboratory tools. Students should be able to acquire new information, plan appropriate investigations, use a variety of scientific tools, and communicate the results of their investigations.