

## DETERMINATION OF VOLUME

### PROBLEM PRESENTATION / EXPLORATION

- A. Students are to rank (from smallest to largest) a series of objects (see B below) in terms of the objects' volume. The series will contain both regularly and irregularly shaped objects.
- B. Station Setup
  1. Five stations will identically be equipped with a metric ruler, a 100 mL graduated cylinder, a large beaker, a small beaker (this should fit inside the large beaker).
    - a.) a paperback book
    - b.) a new piece of chalk
    - c.) a piece of rope
    - d.) 5 marbles
    - e.) a lead sinker
    - f.) a small container of olive or mineral oil
  2. Students will then be instructed to predict the volume of each of the objects.
  3. Next, the volume of each object should be measured using the materials at their lab stations.
  4. The objects should then be ranked, from lowest to largest volume.

### CLASS RESPONSE / CONCEPT INVENTION

- A. Have each group record its findings on a transparency or on the chalkboard.
- B. Also have each group give a brief report on the methods used in calculating the volume for each object. Examine the idea that two objects can't be at the same place at the same time. Therefore, when the lead sinker was put into the graduate cylinder of water, it displaced a volume of water equal to the volume of the sinker. This made the combined volume greater by a volume equal to that of the sinker.
- C. Assuming that there will be some error in the measurements, have the class discuss possible sources of error.

### CONCEPT EXTENSION

- A. A classroom CHALLENGE could be to design a way to measure the volume of a human being, preferably, one of the class members. This design should actually be carried out so that a numerical value for the student's volume will be obtained. A photograph of any equipment or "contraptions" used should be provided.
- B. Explain to students that the volume of all objects cannot be measured directly. Sometimes indirect methods must be employed to find the volume of a single object.
  1. Set up 5 identical stations, each containing a birthday candle, a ream of paper, 50 pennies, a spoonful of sugar, a graduated cylinder, a metric ruler, a bottle of rubbing alcohol, and water.
  2. Ask students to determine the volume of the birthday candle, 1 piece of paper, 1 penny, and the sugar, using the materials at their station. [The birthday candle will float in water, but sink in the alcohol, therefore, its volume can be found by displacement of alcohol instead of displacement of water. The sugar will dissolve in water making it difficult to find its volume by water displacement, but it will not dissolve in alcohol; once again substituting alcohol makes this a logical extension of the volumes that have been found by indirect means. Students will need to measure the volume of all 50 pennies and then divide by 50. Likewise, the volume of a single piece of paper comes from finding the volume of the ream of paper and dividing by 500.]