Unit II: Surface Area and Volume

Teachers' Notes on Meaning Activities

Activity 1

The realization that several nets are possible is important. A discussion about which possible net is the "most explanatory" would be instructive.

Activity 2

Detailed breakdown of the surface area of a rectangular prism can result in a formula for its surface area.

Activity 3

Taking polygons apart that have been constructed from nets is very meaningful. A good net is one that "explains" the polyhedron. Again, keeping track of these activities in a notebook is very helpful for learning.

Activity 4

This manipulative activity reinforces the concept of volumes consisting of layers which in turn consist of unit cubes. An interesting activity related to this: Given 30 cubes, build a rectangular prism. How many different ones can you build?

Ans.: 5 x 3 x 2 / 5 x 6 x 1 / 30 x 1 x 1 / 15 x 2 x 1 / 10 x 3 x 1

Activity 5

Students will need to be "talked through" this activity because it is dependent on the polyhedron chosen. There are good possibilities for group work and discussion.

Activity 6

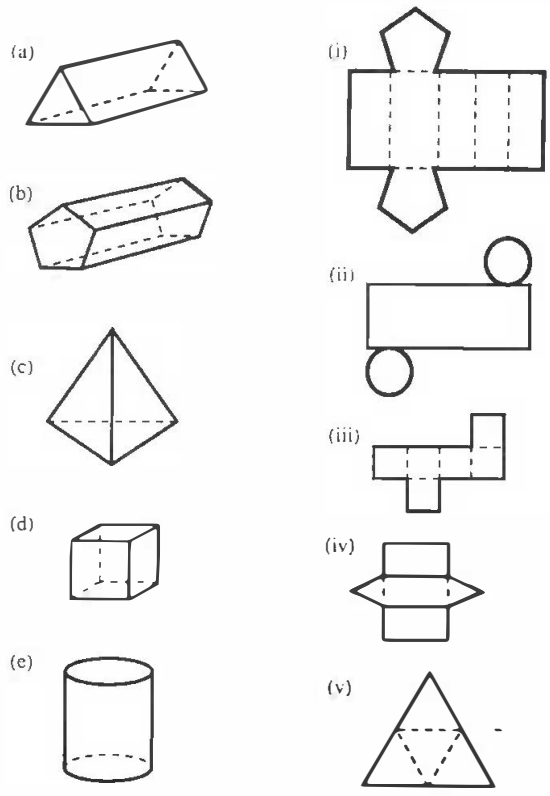
This activity depends on which materials are available. The idea is that volumes calculated through measurements and formulas should yield the same answers as those obtained through experiments. In itself, the episode is an important aid in learning.

Activity 7

This activity is more difficult because the cutouts do not match the drawings exactly. Once the students have constructed the objects, ask them to reconstruct the square.

Meaning Activity 1 Polyhedrons

1. Match the polyhedron with its net.



(a) ____ (b) ____ (c) ____ (d) ____ (e) ____

2. Using the given nets, sketch at least one other net that will produce the same polyhedron.

(i)

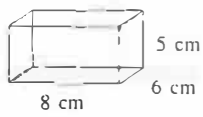
(ii)

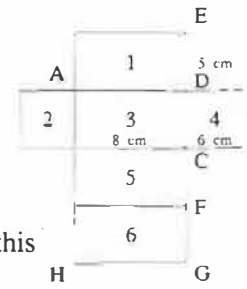
(iii)

(iv)

(v)

Meaning Activity 2 Prisms and Pyramids





1. How many faces make up this prism? ___
2. What is the length of AD? ___
3. What is the length of DE? ___
4. What is the length of CF? ___
5. What is the length of FG? ___
6. What is the length of GH? ___
7. Find the area of each face: 1 ___
   2 ___
   3 ___
   4 ___
   5 ___
   6 ___
8. What is the total area? _____
9. Which faces have the same area? _____
10. Can you find a shortcut for finding the total surface area?
    Explain: _____

Meaning Activity 3 Surface Area

1. Begin with a polyhedron that you have built.
   (a) Cut it apart to make a "good" net.
   (b) Find the area of every face. (Mark in altitudes of triangles.)
   (c) Find the total surface area.
   (d) Compare the surface area of your polyhedron with that of your neighbor. Which has the longest edge?
2. Cylinders:
   Materials: 1 sheet of ordinary paper, 2 paper clips
   Instructions:
   (a) Fold the paper to make a smaller rectangle.
   (b) Make a cylinder with your paper, using paper clips to hold it.
   (c) Find the surface area of your cylinder. Measure with a ruler. Include the top and bottom.
3. Find a cylinder using some object from home or school. Find the surface area of the cylinder. This can be done either by cutting out paper to fit your cylinder or by taking measurements. If you cut out shapes, glue them in your notebook.

Meaning Activity 4 Volume of Rectangular Prisms

1. Using 24 blocks (cubes), construct a rectangular shape, using a single layer.
   (a) What are the dimensions?
   (b) What is this polyhedron called?
   (c) What are the units of this shape?
   (d) What is its volume?
2. Build a second layer on top of the first. Answer questions 1a to 1d again.
3. What are the answers to 1a to 1d when you build five layers? Ten layers?
4. Using five blocks, construct a tower.
   (a) What are the dimensions?

(b) What is this polyhedron called?

(c) What is its volume?

5. Build a second tower beside the first. Answer questions 4a to 4c again.
6. If you build 10 towers in two rows of five blocks, what would be the total volume?
7. Suppose you had 150 blocks in a rectangular shape 5 blocks high. What may the dimensions of the base (first layer) be?
8. If you had an aquarium with dimensions 15 cm by 20 cm by 30 cm, what would its shape be called? How long, wide, high? What is its volume?

Meaning Activity 5 Polyhedron Construction

Take any polyhedron that you have made and do the following activity.

1. Name the polyhedron.
2. Number its faces (with large numbers).
3. Draw a net of this object (not the same as the original).
4. Write formulas for the area of each face and for the total surface area.
5. Sketch lines on your polyhedron that will help you understand its volume. Describe to others the volume of the polyhedron.
6. With a ruler, measure the polyhedron's dimensions, including its altitude if appropriate. From these measurements, determine its volume. Determine its surface area.
7. In a different color pen, draw markings indicating the planes of symmetry of your polyhedron.
8. Cut open one face of your polyhedron, and if possible fill it with centimetre cubes. Does this volume compare favorably with the calculated volume (question 6)?
9. Cut open your polyhedron and paste it in your notebook.

Meaning Activity 6 Volume, Capacity and Mass

Teacher Sheet

Materials required:

2-L measuring device with marked graduations
10-cm^3 container
1-L bottle (soft drink)
3 or 4 square-sided containers (milk, juice cartons)
3 or 4 straight-sided cylindrical containers (glasses, coffee mugs, tins)
3 or 4 submersible blocks

The object of the experiment is to compare calculated volumes with measured capacities.

Have students measure the objects. Have them calculate the volumes. Compare these calculations by seeing how large the object is either by how much water it will hold or by how much water it displaces.

Method 1

Use the submersion method to determine the volumes (capacities) of irregularly shaped objects.

Method 2

The containers may be weighed, first empty, then full. This may be another way of determining capacity (volume).

Meaning Activity 7

Materials: Scissors

Cut out the "tangram square" and cut it into its seven parts.

See if you can duplicate the figures below using the seven shapes.

Can you make some of your own?