New Boxes From Old
Instructions for Students

In this exercise, you will take one of your two identical boxes and cut it up to make a new box that is cube-shaped. Both boxes will have the same volume--but will they have the same surface areas? By the time you have finished making your new box, you should be able to answer this question.

The directions below will help you construct your cube-shaped box, after which you will be able to draw some conclusions about the relationships between volumes and surface areas of boxes. *PLEASE read through ALL the directions BEFORE beginning!!!*

1. Measure each dimension (length (*L),* width *(W),* and height (*H*)) of your box to the nearest millimeter.

L = *W* = *H* =

2. Calculate the surface area (*SA)* of your box.

SA =

3. Calculate the volume *(V)* of your box.

V =

Did you remember to include units in your answers?

4. Carefully open the glued edges of your box; it was probably made from one flat piece of cardboard. Cut off any parts of flaps that were hidden from view when the box was still intact. The hidden parts are usually easy to spot because they generally don't have any color on them and/or they do have dried glue on them. You can also look at your other box to make sure. *Please check with your teacher if you aren't sure what is okay to cut off!* After you've cut off these hidden parts, throw them away in the trash.

5. Using the volume you determined in step 3, calculate what the length of any side of your new cube-shaped box should be.

Length of any side =

6. Find someone else in the class who has just finished step 5. Trade papers and boxes and check each other's measurements and calculations. If your answers don't agree, work together until you decide which of you is correct.

7. On the inside of your opened-out box, draw the six identical squares you will need to make your cube-shaped box. Remember that their sides must all equal the length you calculated in step 5, and the sides must meet at 90° angles. You may find that you can only fit four or five complete squares on your opened-out box. If that is the case, you

will have to take some of the remaining scraps and tape them together, rather like a jigsaw puzzle, to make the last one or two sides of your cube.

8. After you have figured out how to obtain all six sides of your cube, cut them out. *Important: save any remaining scraps!* Put them in an envelope or zipper-type plastic bag. (It's okay to fold them if you need to.)

9. As neatly as you can, tape the six squares together to form your cube-shaped box. It will be sturdy and look good if you use masking tape on the *inside* of the cube to attach adjacent squares and then use clear tape only on the *outside* for additional strength.

10. Calculate the surface area of your cube-shaped box.

SA of cube =

11. Compare this number to the surface area of the original box, which you determined in step 2. Are they the same?

If not, by how much do they differ?

Difference in surface areas =

12. Find the area of each of the scraps. Since some of them may be oddly-shaped, you may want to divide them into squares and rectangles that will be easier to measure and calculate areas for. After you have determined all of their areas, add them up to get one total area of the scraps.

Total area of scraps =

13. Compare this number to the number you got in step 11.

Are the two areas the same?

Should they be the same?

Why or why not?