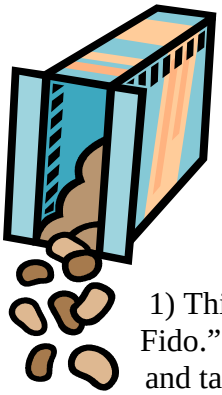
LessonTitle: Measuring Prisms and Cylinders	**Geo 5.5**
Utah State Core Standard and Indicators Geometry Standards 4.2 Process Standards 1-5	
Summary In this lesson, students examine the concepts of volume and surface area by first making a net out of a cereal box. Then in the activity called "Packing the Packages," they find the maximum volume and related surface areas for different sized boxes created by cutting the corners out of graph paper and folding up the sides. Instructions for building an origami box are also included. In 5.5b, students do a similar activity using cylinders and then do a fun activity called "Will you be Wet or Dry?"	
Enduring Understanding Problem solving related to volume and surface area of prisms and cylinders is important in real life applications.	**Essential Questions** What kind of box or can will hold the most and take the least amount of material to make?
Skill Focus • Maximum volume as related to surface area, rectangular prisms and cylinders.	**Vocabulary Focus**
Assessment	
Materials: Graph paper, scissors, cereal box, different kinds of containers	
Launch	
Explore	
Summarize	
Apply	

Directions:
In Geo 5.4a Packing the Packages, help students generate the formula for the volume of a rectangular prism as the area of the base * height. Then help them transfer that formula to the volume of a cylinder. (They should know how to find the area of the base of a cylinder.) ***Have students present their thinking and strategies and conclusions.***

After students have developed the concept of volume and surface area, it's fun to have them build the origami open topped box and find the surface area and volume. Fill the box with popcorn after they build it and successfully find the volume and surface area (see associated link for directions).

Geo 5.5b Follow-up with the "Volume of cylinders" activity. Another fun alternative or additional activity,Will You Be Wet or Dry, is also included

Geo 5.5a Packing the Packages



Did you ever notice that cereal comes in tall, thin boxes and that laundry soap comes in short, wide boxes? Why do you think they come as they do?

1) Think about your findings in "Building a fence for Fido." What kind of box do you predict might hold the most and take the least amount of cardboard?

2) We might call the perimeter of a polygon a fence. What are some other words or ideas which might describe the edge of a polygon or circle?

How can you describe the area of a polygon or circle?

3) What are some words or ideas which could be used to describe the surface of a box?

How would you describe what goes inside a box?

4) Suppose your favorite cereal comes in a box that is 24 cm. high, 20 cm. long, and 6 cm. wide. Sketch the parts below. Label the dimensions.

Box bottom Box front Box side

5) Draw a net for your cereal box. Use graph paper.

6) This opened up box shows the surface area of your box. Find the following areas:
Show your work.

The bottom of your box._____

The front of your box._____

The side of your box._____

The total surface area of your box._____

7) Now lets investigate the kind of box which would hold the most and use the least amount of packaging.

- Take a piece of centimeter graph paper. (Cut off the edges if necessary so that every square is a full centimeter wide.)
- Cut out one centimeter from each corner. Then fold up the strips left on each edge and tape to make a 1 cm. tall flat box. How many square centimeters could fill this box? Record the information below. (For surface area purposes, assume that the box would have a top even though the model doesn't.)
- Now increase the cutout from the corner to become 2 cm by 2 cm wide. Fold up the sides to be 2 cm high. Record the information. Continue the pattern. (Please note that you are cutting away material—this would be considered wasted. Perhaps amount of waste is also a consideration when deciding on the shapes of boxes.)

Length														
Width														
Height	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Surface Area														
Volume														

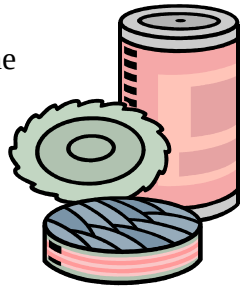
Circle the Box dimensions above which give the maximum volume and minimum surface area. Write your ideas below regarding efficient box shapes. Relate back to your prediction and the data above.

8) The formula for finding volume of a right rectangular prism is V = LWH.
Explain this formula.

9) Considering what you learned above, why do you think cold cereal makers choose the box shapes they do?

10) Because a cubic cm. of a solid is equal to _____ml of water, you can transfer from volume to capacity easily in metrics. If your most efficient box from question 6 above could hold water, how much water would there be?_____

11) Now lets look at soup or tuna fish cans. Why are soup cans tall and tuna cans short?



- What kind of can would you predict to hold the most and use the least amount of packaging?

- To find out how to create a net for a cylinder, use an empty paper towel or toilet paper roll. Cut the roll from top to bottom. Open it out. What shape is it?_____

- Now create a net for a soup can. Use graph paper. What measurements do you need?
  _____ _____ _____

  Find the measurements. Show all work._____ _____ _____

12) Use your knowledge of box volume to figure out a formula for finding the volume of a cylinder. V(cylinder) = _____

13) Find the following. Show all work. Surface areas: Volumes::

Soup Can	_____	_____
Tuna Can	_____	_____

14) Why do you think companies choose the cans they do?