Lesson 19: Surface Area and Volume in the Real World

Classwork

Opening Exercise

A box needs to be painted. How many square inches will need to be painted to cover every surface?

$$15 in.$$

$$6 in.$$

$$12 in.$$

A juice box is $4 in.$ tall, $1 in.$ wide, and $2 in.$ long. How much juice fits inside the juice box?

How did you decide how to solve each problem?

**Discussion**

Example 1

Vincent put logs in the shape of a rectangular prism. He built this rectangular prism of logs outside his house. However, it is supposed to snow, and Vincent wants to buy a cover so the logs will stay dry. If the pile of logs creates a rectangular prism with these measurements:

$33 cm$ long, $12 cm$ wide, and $48 cm$ high,

what is the minimum amount of material needed to make a cover for the wood pile?

Exercises 1–6

Use your knowledge of volume and surface area to answer each problem.

1. Quincy Place wants to add a pool to the neighborhood. When determining the budget, Quincy Place determined that it would also be able to install a baby pool that required less than $15$ cubic feet of water. Quincy Place has three different models of a baby pool to choose from.

Choice One: $5 feet×5 feet×1 foot$

Choice Two: $4 feet×3 feet×1 foot$

Choice Three: $4 feet×2 feet×2 feet$

Which of these choices is best for the baby pool? Why are the others not good choices?

1. A packaging firm has been hired to create a box for baby blocks. The firm was hired because it could save money by creating a box using the least amount of material. The packaging firm knows that the volume of the box must be $18 cm^{3}.$
	1. What are possible dimensions for the box if the volume must be exactly $18 cm^{3}$?
	2. Which set of dimensions should the packaging firm choose in order to use the least amount of material? Explain.
2. A gift has the dimensions of $50 cm×35 cm×5 cm$. You have wrapping paper with dimensions of $75 cm×60 cm$. Do you have enough wrapping paper to wrap the gift? Why or why not?
3. Tony bought a flat rate box from the post office to send a gift to his mother for Mother’s Day. The dimensions of the medium size box are $14 inches×12 inches×3.5 inches$. What is the volume of the largest gift he can send to his mother?
4. A cereal company wants to change the shape of its cereal box in order to attract the attention of shoppers. The original cereal box has dimensions of $8 inches×3 inches×11 inches$. The new box the cereal company is thinking of would have dimensions of $10 inches×10 inches×3 inches$.
	1. Which box holds more cereal?
	2. Which box requires more material to make?
5. Cinema theaters created a new popcorn box in the shape of a rectangular prism. The new popcorn box has a length of $6 $inches, a width of $3.5 $inches, and a height of $3.5 $inches but does not include a lid.

$$6 in.$$

$3.5 in$.

$$3.5 in.$$

* 1. How much material is needed to create the box?
	2. How much popcorn does the box hold?

Problem Set

Solve each problem below.

1. Dante built a wooden, cubic toy box for his son. Each side of the box measures $2 $feet.
	1. How many square feet of wood did he use to build the box?
	2. How many cubic feet of toys will the box hold?
2. A company that manufactures gift boxes wants to know how many different sized boxes having a volume of $50$ cubic centimeters it can make if the dimensions must be whole centimeters.
	1. List all the possible whole number dimensions for the box.
	2. Which possibility requires the least amount of material to make?
	3. Which box would you recommend the company use? Why?
3. A rectangular box of rice is shown below. How many cubic inches of rice can fit inside?

$$15\frac{1}{3} in.$$

$$6\frac{1}{3} in.$$

$$7\frac{2}{3} in.$$

1. The Mars Cereal Company has two different cereal boxes for Mars Cereal. The large box is $8 $inches wide, $11 $inches high, and $3 $inches deep. The small box is $6 $inches wide, $10 $inches$ $high, and $2.5 $inches$ $deep.
	1. How much more cardboard is needed to make the large box than the small box?
	2. How much more cereal does the large box hold than the small box?
2. A swimming pool is $8 $meters long, $6 $meters wide, and $2 $meters deep. The water-resistant paint needed for the pool costs $\$6$ per square meter. How much will it cost to paint the pool?
	1. How many faces of the pool do you have to paint?
	2. How much paint (in square meters) do you need to paint the pool?
	3. How much will it cost to paint the pool?
3. Sam is in charge of filling a rectangular hole with cement. The hole is $9 $feet long, $3 $feet wide, and $2 $feet deep. How much cement will Sam need?
4. The volume of Box D subtracted from the volume of Box C is $23.14 $cubic centimeters. Box D has a volume of $10.115$ cubic centimeters.
	1. Let $C$ be the volume of Box C in cubic centimeters. Write an equation that could be used to determine the volume of Box C.
	2. Solve the equation to determine the volume of Box C.
	3. The volume of Box C is one-tenth the volume another box, Box E. Let $E$ represent the volume of Box E in cubic centimeters. Write an equation that could be used to determine the volume of Box E, using the result from part (b).
	4. Solve the equation to determine the volume of Box E.