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Modeling: Understanding Modeling

Whenever a student or teacher creates a three-dimensional, physical representation of a drawn object, he is creating a **model.** Models are a way of applying geometric concepts in the real world. There are three ways that we will address models in this worksheet:

1. To describe objects;
2. To identify density based on area and volume;
3. To solve a design problem.

We can use geometric shapes, their measures, and their properties to describe the following:

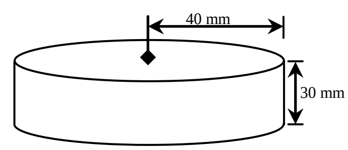
Example: Tyler is attempting to make and sell his own hockey pucks to raise money for his hockey team. If a standard puck has a radius of 40 mm, and a height of 30 mm, identify (1) the shape and measurement of the object, (2) the volume of vulcanized rubber he will need to pour into his mould.

Step 1: Identify the shape and measure of the object.

The hockey puck has parallel circular surfaces connected by a curved lateral surface, making it a cylinder.

Using the information provided, calculate the surface area of the base:

$\pi r^2 = \pi(40mm)^2 = \pi(1600mm^2) \approx 5{,}027\ mm^2$



Step 2: Identify the volume of the cylinder.

Since we are given the dimensions of the surface areas, we can calculate the volume of vulcanized rubber required for each puck.

The volume of a cylinder with base area *B* and radius *r* and height *h* is V = Bh

$V = (5027mm^2)\cdot(30mm)$

$V = 150{,}810\ mm^3$

For his project, Tyler would need to use 150,810 mm^3 of vulcanized rubber for each puck he produces.

Problem Solving: After creating his first few homemade pucks, Tyler realizes that he has forgotten to figure in for the protective coating that surrounds the puck. If he used the same material for the coating, adding 2 mm all around, determine which of the following accurately describes the total amount of vulcanized rubber he will need to produce one puck.

A. 177,337.6 mm^3 B. 166,254 mm^3 C. 301,620 mm^3 D. 188,421.2 mm^3

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Practice Problem Solution:

In order to find the new total, we need to factor in an additional 2 mm all around the object. This changes our original measurements to a radius of 42 and a height of 34.
As a result, the correct answer would be D above.

Worksheet Questions

1. Identify what object is created by stacking four 10-inch free weights together.

2. If each free weight is 2 inches tall, determine the total surface area of the stack of four weights.

3. Calculate the total volume of the four weights.

4. Predict whether the measurement you calculated in #3 will change if you stack them next to each other. Explain why or why not.

5-10. Using common household objects, describe how you might make a model of each of the following objects. Then, determine the volume or density for each.

5. A prism: ℓ=4″, w=4″, h=5″

6. A cylinder: h=2″, d=9″

7. A cylinder: h=6″, d=5″

8. A cylinder: h=11″, d=7″

9. A cylinder: h=8″, d=4″

10. A prism: ℓ=10″, w=5″, h=4″

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Answer Key

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1. Cylinder
2. 408.41 in^2
3. 628.32 in^3
4. No, it will be the same. The dimensions used to determine volume do not change when the weights are stacked in different ways.

5-10. Answers may vary. Below are some options:

5. Square tissue box
6. 9” round cake pan
7. Toilet paper roll
8. Paper towel roll, vase
9. Glass or cup
10. Tissue box or shoe box