Name: December 8

Quiz 5

With your newfound knowledge of area and volume, you've gotten a job at the Frobnitz Widget Company.

1. Frobnitz Widgets ships its widgets all over the world. A standard widget is a sphere with radius 4 centimeters, made of solid tungsten. If tungsten weighs 20 grams per cubic centimeter, how much does a widget weigh? (Hint: Find the volume of a widget first.)

First, the volume:

$$V = \frac{4}{3}\pi r^3 = \frac{4}{3} \cdot \pi \cdot (4\,\text{cm})^3 = \boxed{268.08\ \text{cm}^3}$$

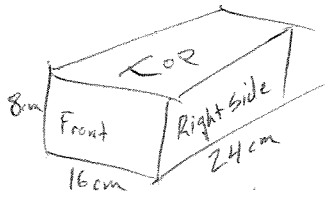
Now, the weight:

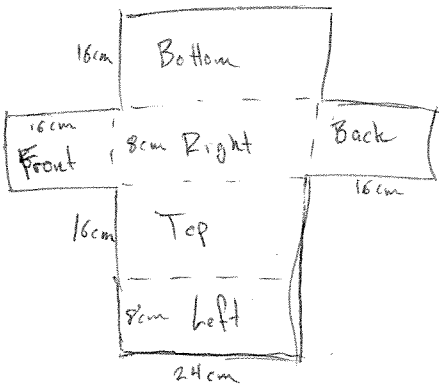
$$\text{Volume} \cdot \text{density} = 268.08\ \text{cm}^3 \cdot \frac{20\ \text{g}}{1\ \text{cm}^3} = \boxed{5362.9\ \text{g}}$$

2. Amazon.com has started ordering widgets in units of six. You have designed a widget box for them that is eight centimeters tall, sixteen centimeters wide, and 24 centimeters long.

(a) How much cardboard do you need to make the box?

The box has 6 faces:





So the surface area is:

Area of the top & bottom:
$16\text{cm} \cdot 24\text{cm} = 384\text{cm}^2$

Area of the front & back:
$8\text{cm} \cdot 16\text{cm} = 128\text{cm}^2$

Area of the top & bottom:
$8\text{cm} \cdot 24\text{cm} = 192\text{cm}^2$

Total then:

$2 \cdot 16\text{cm} \cdot 24\text{cm} + 2 \cdot 8\text{cm} \cdot 16\text{cm} + 2 \cdot 8\text{cm} \cdot 24\text{cm} = 1408\text{cm}^2$

$\boxed{1408\text{cm}^2}$

(b) How much space is wasted? That is, how much space in the box isn't taken up by widgets?

That's the VOLUME of the box minus the VOLUME of six spheres.

Volume of box:

$8\text{cm} \cdot 16\text{cm} \cdot 24\text{cm} = 3072\text{cm}^3$

So: $3072 - 6 \cdot 268.08 = \boxed{1463.52\text{cm}^3}$

Volume of a widget.