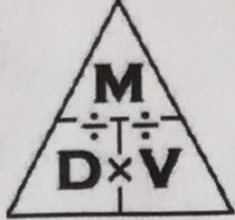


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### LESSON #5: DENSITY

<u>mass</u> <u>volume</u> <u>Density</u>	is commonly measured by how much something <u>weighs</u> is the amount of 3 dimensional space an object occupies (capacity) how much mass per unit of volume.	
Formulas: $D = \frac{m}{V}$	$V = \frac{m}{D}$	$M = D \times V$
<b>** Be careful with your units**</b>		

1. A loaf of bread has a volume of 2270 cm<sup>3</sup> and a mass of 454 g. What is the density of the bread?

$$D = \frac{m}{V} \quad D = \frac{454g}{2270cm} = .2 g/cm^3$$

2. A machine shop worker records the mass of an aluminum cube as 176 g. If one side of the cube measures 4 cm, what is the density of the aluminum?

$$D = \frac{m}{V} \quad D = \frac{176g}{64cm} = \boxed{2.75 g/cm^3}$$

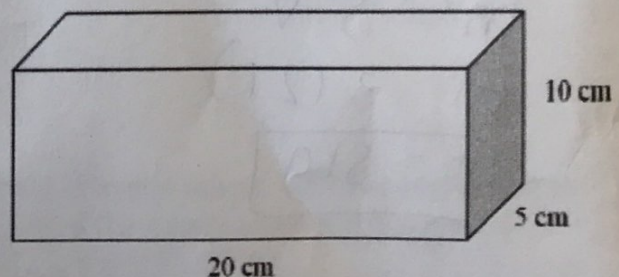
$$V = 4^3$$
$$V = 64cm^3$$

3. A carver begins work on the following block of granite that weighs 2700 g. What is the density of the granite?

$$D = \frac{m}{V}$$

$$D = \frac{2700g}{1000cm}$$

$$\boxed{D = 2.7 g/cm^3}$$



$$V = l \cdot w \cdot h$$
$$V = 20 \cdot 5 \cdot 10$$
$$V = 1000cm^3$$

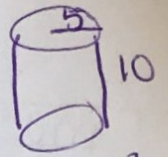
4. A metal cup full of water has a mass of 1,000 g. The cup itself has a mass of 214.6 g. If the cup has both a diameter and height of 10 cm, what is the approximate density of water?

$$\frac{\text{Density (cup w/ water)} - \text{Density (cup)}}{\text{mass}}$$

$$1000 - 214.6 = 785.4 \text{ g} = M$$

$$D = \frac{m}{V}$$

$$D = \frac{785.4 \text{ g}}{250\pi \text{ cm}} = \boxed{1 \text{ g/cm}^3}$$



$$V = \pi r^2 h$$

$$V = \pi \cdot 5^2 \cdot 10$$

$$V = 250\pi$$

5. You threw a plastic ball in the pool for your dog to fetch. The mass of the ball is 125 grams. What must be the volume to have a density of 0.500 g/mL?

$$D = \frac{m}{V}$$

$$0.5 \text{ g/mL} = \frac{125 \text{ g}}{V}$$

$$0.5V = 125$$

$$V = 250 \text{ mL}^3$$

6. A square metal plate has a density of 10.2 g/cm<sup>3</sup> and weighs 2.193 kg. Calculate the volume of the plate. BE CAREFUL!

$$V = \frac{m}{D}$$

$$V = \frac{2193}{10.2}$$

$$V = 215 \text{ cm}^3$$

K H D U D C M

kg g

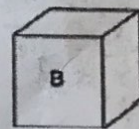
$$2.193 \text{ kg} = 2,193 \text{ g}$$

7. Given the diagram to the right, what is the mass of cube B?

$$m = D \cdot V$$

$$m = 3 (27)$$

$$m = 81 \text{ g}$$



Density of B = 3 g/cm<sup>3</sup>

Volume of B = 27 cm<sup>3</sup>

8. A cylinder contains lead that is 2.50 cm in diameter, and 5.50 cm long. If the density of the lead is 11.4 g/mL, what is the mass of the cylinder, to the nearest tenth?

$$V = \pi (1.25)^2 (5.50)$$

$$V = 8.59375\pi$$

$$m = D \cdot V$$

$$m = 11.4 \cdot 8.59375\pi$$

$$m = 307.8 \text{ g}$$

9. Mary purchased a new drawing box. The height, width and length of the box are 12 cm, 6 cm, and 3 cm, respectively. She wants to fill the box with pencils. The density of a pencil is 0.03 pencils per cubic cm. How many total pencils can she fit in the drawing box?

$$V = l \cdot w \cdot h$$

$$V = 12 \cdot 6 \cdot 3$$

$$V = 216 \text{ cm}^3$$

$$m = D \cdot V$$

$$m = .03 \cdot 216$$

$$m = 6.48$$

$$\boxed{6 \text{ pencils}}$$

10. The density of the American white oak tree is 752 kilograms per cubic meter. If the trunk of an American white oak tree has a circumference of 4.5 meters and the height of the trunk is 8 meters, what is the approximate number of kilograms of the trunk?

$$V = \pi r^2 h$$

$$C = 2\pi r$$

$$\frac{4.5}{2\pi} = \frac{2\pi r}{2\pi}$$

$$r = \frac{2.25}{\pi}$$

$$V = \pi \left( \frac{2.25}{\pi} \right)^2 (8)$$

$$V = 12.8915$$

$$V = 12.8915$$

$$m = D \cdot V$$

$$m = 752 \cdot 12.8915$$

$$m = 9694.408$$

$$\boxed{m = 9694}$$

11. Molly wishes to make a lawn ornament in the form of a solid sphere. The clay being used to make the sphere weighs .075 pound per cubic inch. If the sphere's radius is 4 inches, what is the weight of the sphere to the nearest pound?  $\rightarrow$  DENSITY!

$$V = \frac{4}{3} \pi (4)^3$$

$$V = 85.3\pi$$

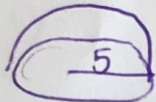
$$m = D \cdot V$$

$$m = .075 \cdot 85.3\pi$$

$$m = 20.0983$$

$$\boxed{m = 20 \text{ lbs}}$$

12. A hemispherical water tank has an inside diameter of 10 feet. If water has a density of 62.4 pounds per cubic foot, what is the weight of the water in a full tank, to the nearest pound?



$$V = \frac{4}{3}\pi r^3$$

$$V = \frac{4}{3}\pi(5)^3$$

$$V = \frac{500\pi}{3}$$

2

$$V = \frac{250\pi}{3}$$

$$m = D \cdot V$$

$$m = 62.4 \cdot \frac{250\pi}{3}$$

$$m = \cancel{32672.5636} \quad 16336.2818$$

$$m = \cancel{32673} \text{ lbs}$$

$$m = 16336 \text{ lbs}$$

#### POPULATION DENSITY

Record the classroom dimensions and population below. Then, calculate the area and amount of classroom space per person.

Length = 25      Width = 30

Area = 750 ft<sup>2</sup>

4. Schuhlsville is an island of 5000 square miles off the coast of Jabooty. There are currently 250,000 inhabitants of the island. What is the current population density?

$$\frac{250,000}{5000} = 50 \text{ people/square mile}$$

**EXTRA PRACTICE**

What is the density of a piece of wood that has a mass of 25.0 grams and a volume of 29.4 cm<sup>3</sup>, to the nearest hundredth?

$$D = \frac{25.0g}{29.4cm} = 0.85 g/cm^3$$

A cube has a side that is 3 cm long. It has a density of 2 gm/cc. What is its mass?

$$m = D \cdot V$$

$$m = 2 \cdot 27$$

$$m = 54 \text{ gm}$$

$$V = l \cdot w \cdot h$$

$$V = 3 \cdot 3 \cdot 3$$

$$V = 27 \text{ cm}^3$$

A cube has a mass of 128 grams and a density of 2 gm/cc. Find the length of one side.

$$V = \frac{m}{D}$$

$$V = \frac{128}{2}$$

$$V = 64$$

$$V = s^3$$

$$\sqrt[3]{64} = \sqrt[3]{s^3}$$

$$s = 4$$

A piece of wood that measures 3.0 cm by 6.0cm by 4.0 cm has a mass of 80.0 grams. What is the density of wood, to the nearest tenth?

Objects A and B are solid and made of the same uniform material. How does the mass of object B compare to object A?

