

Density

- 1) The volume of a solid gold statue can be approximated as $1,000 \text{ cm}^3$. The density of gold is about 20 g/cm^3 . What is the mass of the statue?

$$20 \text{ g/cm}^3 = \frac{x}{1,000 \text{ cm}^3}$$

$$x = 20,000 \text{ g}$$

- 2) A tanker fills up $2,500 \text{ m}^3$ of steel sank to the bottom of the ocean. The density of steel is about $8,000 \text{ kg/m}^3$. What is the mass of the tanker?

$$8,000 \text{ kg/m}^3 = \frac{x}{2,500 \text{ m}^3}$$

$$x = 20,000,000 \text{ kg}$$

- 3) Hot air is less dense than cool air, so hot air will rise above cool air. The density of hot air is about 0.25 kg/m^3 more than cool air. Find the volume to lift a hot air balloon that weighs 800 kg .

$$.25 \text{ kg/m}^3 = \frac{800 \text{ kg}}{v}$$

$$v = 3,200 \text{ m}^3$$

$$.25v = 800$$

- 4) The density of gold is about 20 g/cm^3 . The solid gold statue can be modeled as a cylinder with a height of 15 cm and a radius of 4 cm . The density of sand can be estimated at 2.5 g/cm^3 .

- a) What is the volume of the statue?

$$V = \pi(4)^2(15)$$

$$= 240\pi$$

$$\approx 753.98 \text{ cm}^3$$

- b) To swap the sand for the statue, the sand MUST have the same mass. What volume of sand will Indiana Jones need to avoid the triggering mechanism & steal the idol?

Gold
statue:

$$20 \text{ g/cm}^3 = \frac{x}{753.98 \text{ cm}^3}$$

$$x = 15,079.6 \text{ g}$$

Sand:

$$2.5 \text{ g/cm}^3 = \frac{15,079.6 \text{ g}}{v}$$

$$2.5v = 15,079.6$$

$$v = 6,031.84 \text{ cm}^3$$

5) Beijing has 20.7 million people and an area of 16,400 km². Shanghai has 23.7 million people and an area of 6,300 km².

a) What is the population density of Beijing?

$$d = \frac{20,700,000 \text{ people}}{16,400 \text{ km}^2} = 1262.2 \text{ people/km}^2$$

b) What is the population density of Shanghai?

$$d = \frac{23,700,000 \text{ people}}{6,300 \text{ km}^2} = 3,761.9 \text{ people/km}^2$$

c) How many times as great is the population density of Shanghai as Beijing?

About 3 x greater

$$\frac{3,761.9}{1262.2} \approx 2.98$$

6) Casandra finds a treasure chest with metallic coins. The chest has a volume of 0.25 m³. The coins have a combined mass of 4,825 kg. Hoping to find gold, she calculates the density to determine the metal of the coins.

$$d = \frac{4,825 \text{ kg}}{0.25 \text{ m}^3} = 19,300 \text{ kg/m}^3$$

What kind of metal are the coins made of?

a) Bronze - 8,700 kg/m³

b) Silver - 10,500 kg/m³

c) Lead - 11,300 kg/m³

d) Gold - 19,300 kg/m³ ☺

7) New York City has 8.3 million people and an area of 1,200 km². Tokyo has 13.2 million people and an area of 2,200 km².

a) What is the density of NYC?

$$d = \frac{8,300,000 \text{ people}}{1,200 \text{ km}^2} = 6,916.7 \text{ people/km}^2$$

b) What is the density of Tokyo?

$$d = \frac{13,200,000 \text{ people}}{2,200 \text{ km}^2} = 6,000 \text{ people/km}^2$$

c) Which city has a greater population density?

New York City!

8) In a regular soda, about 40g of sugar is dissolved in 12 oz of carbonated water. The density of table sugar is 1.6 g/cm^3 . Find the volume of the sugar added to the carbonated water.

$$1.6 \text{ g/cm}^3 = \frac{40 \text{ g}}{v}$$

$$1.6v = 40$$

$$v = 25 \text{ cm}^3$$

9) In a diet soda, about 0.21 g of aspartame (artificial sweetener) is dissolved in 12 oz of carbonated water. The density of aspartame is 1.4 g/cm^3 . What is the volume of the Aspartame added to the carbonated water?

$$1.4 \text{ g/cm}^3 = \frac{0.21 \text{ g}}{v}$$

$$1.4v = .21$$

$$v = .15 \text{ cm}^3$$

How many times greater is the volume of sugar added as the volume of the aspartame added?

$$\frac{25}{.15} \approx 166.7$$

Over 160 times greater

