Name _____ Density Problems 1

1. 25.2 mL of water are placed in a graduated cylinder. A 22.6 gram stone is dropped in, and the water level rises to 32.4 mL. Find the stone's density.

$d = \frac{m}{V} = \frac{22.6\text{ g}}{7.2\text{ mL}} = 3.1\ \text{g/cm}^3$

$32.4\text{ mL} - 25.2\text{ mL} = 7.2\text{ mL} = 7.2\text{ cm}^3$

2. A graduated cylinder is placed on an electronic balance and it reads 78.32 grams. 10.0 mL of glycerine (a liquid) are added and now the balance reads 91.78 grams. What is the density of glycerine?

$91.78\text{ g} - 78.32\text{ g} = 13.46\text{ g}$

$d = \frac{m}{V} = \frac{13.46\text{ g}}{10.0\text{ mL}} = 1.346\ \frac{\text{g}}{\text{mL}}$ $1.35\ \frac{\text{g}}{\text{mL}}$

3. A 3.0 cm X 4.4 cm X 6.7 cm brick has a mass of 985 grams. What is the density of the brick?

$V = 3.0\text{ cm} \times 4.4\text{ cm} \times 6.7\text{ cm} = 88.44\text{ cm}^3$

$d = \frac{m}{V} = \frac{985\text{ g}}{88.44\text{ cm}^3} = 11.137\ \frac{\text{g}}{\text{cm}^3}$

$11\ \frac{\text{g}}{\text{cm}^3}$

4. A solid metal cylinder has a mass of 528.6 grams, a length of 14.2 cm, and a diameter of 2.30 cm. What is the density of the metal?

$V = \pi r^2 h = \pi (1.15\text{ cm})^2 14.2\text{ cm} = 58.9975\text{ cm}^3$

$d = \frac{m}{V} = \frac{528.6\text{ g}}{58.9975\text{ cm}^3} = 8.959\ \frac{\text{g}}{\text{cm}^3} = 8.96\ \frac{\text{g}}{\text{cm}^3}$

5. A ball has a mass of 753 grams and a radius of 5.62 cm. What is the density of the ball?

$V_{ball} = \frac{4}{3}\pi r^3 = \frac{4\pi (5.62\text{ cm})^3}{3} = 743.52839\text{ cm}^3$

$d = \frac{m}{V} = \frac{753\text{ g}}{743.52839\text{ cm}^3} = 1.0127\ \frac{\text{g}}{\text{cm}^3} = 1.01\ \frac{\text{g}}{\text{cm}^3}$

6. A ball has a mass of 753 grams and a radius of 5.62 cm. Will the ball float or sink in pure water? (Pure water has a density of 1.00 g/cm³)

It should sink because it is more dense than the water.

7. What is the mass of a 15.2 cm³ chunk of styrofoam? (styrofoam has a density of 0.145 g/cm³)

$d = \frac{m}{V}$ so $m = dV = 0.145\ \frac{\text{g}}{\text{cm}^3}(15.2\text{ cm}^3) = 2.204\text{ g} = 2.20\text{ g}$

8. What is the mass of a 15.2 cm³ chunk of osmium? (osmium has a density of 22.6 g/cm³)

$d = \frac{m}{V}$, $m = dV = 22.6\ \frac{\text{g}}{\text{cm}^3}(15.2\text{ cm}^3) = 343.52\text{ g} = 344\text{ g}$

Name _____ Density Problems 2

1. A metal cylinder has a diameter of 4.0 cm and a height of 12.0 cm. If its mass is 0.245 kg, what is its density in g/cc?

$V = \pi r^2 h = \pi (2\,cm)^2 \, 12.0\,cm = 150.796\ldots cm^3$

$d = \frac{m}{V} = \frac{245\,g}{150.796\ldots cm^3} = 1.6\ g/cm^3$

2. If Jay displaces 21.4 liters of water when he sits in the bathtub, what is Jay's mass in kilograms? (The density of the human body is 4.0 g/cc.)

$d = \frac{m}{V}, \quad m = dV = 4.0\ \frac{g}{mL} \times 21400\,mL = 85600\,g = 86\,kg$

3. A metal object with a mass of 124 grams is placed in a graduated cylinder containing 0.22 liters of water. The water rises up to the 0.51 liter mark. What is the density of the metal in g/cm³?

$.51\,L - .22\,L = .29\,L$ or $290\,mL$

$d = \frac{m}{V} = \frac{124\,g}{290\,mL} = .43\ \frac{g}{mL}$

4. A laundry tub has a capacity of 67 liters when completely full. If you fill the tub with 37 liters of water, will it overflow when you submerge in it a steel drum with the following dimensions: diameter 19 cm, and length 102 cm?

$V = \pi r^2 h = \pi (9.5\,cm)^2 \, 102\,cm = 28919.931\,cm^3 = mL$

$= 28.9199\,L$

$28.919\,L + 37\,L = 66L \therefore$ no, it won't overflow

5. The density of a solution is 0.82 g/mL. What will be the mass (in kg) of 65 liters of this solution?

$d = \frac{m}{V}, \quad m = dV = 0.82\ \frac{g}{mL} \times 65000\,mL = 53300\,g$

$= 53\,kg$

6. A solid cylinder with a mass of 2.34 kg displaced 9.8 ml of water when submerged. If the diameter of the cylinder is 2.0 cm, what is the height of the cylinder?

$V = \pi r^2 h$, $h = \frac{V}{\pi r^2} = \frac{9.8\,cm^3}{\pi (1\,cm)^2} = 3.1194\,cm = 3.1\,cm$

7. A solution has a density of of 2.30 g/mL. What volume will 58 grams of the solution occupy?

$d = \frac{m}{V}$, $V = \frac{m}{d} = \frac{58\,g}{2.30\,g/mL} = 25\,mL$

8. An aluminum cylinder has a mass of 878 grams, a diameter of 3.8 cm, and a height of 23 cm. What is its density?

$V = \pi r^2 h = \pi (1.9\,cm)^2\, 23\,cm = 260.846\,cm^3$

$d = \frac{m}{V} = \frac{878\,g}{260.846\,cm^3} = 3.4\,\frac{g}{cm^3}$

9. A perfect cube has a mass of 610 g and a density of 4.8 g/cc. What is the length of one of its sides? $= 5.0\,cm$

$V_{cube} = l \times w \times h$, but because all sides of a perfect cube are equal

then $V = s^3$, $s = \sqrt[3]{V}$ $V = \frac{m}{d} = \frac{610\,g}{4.8\,g/cc} = 127.08\,cm^3$

10. A cup will hold 300 mL when filled to its brim. You place 250 mL of water in it. A marble has a mass of 120 g in air and 64 g in water. Will the cup of water overflow if you place the marble in it?

skip

11. 43 mL of an unknown liquid has a mass of 49 grams. What is the liquid's density?

$d = \frac{m}{V} = \frac{49\,g}{43\,mL} = 1.1\,\frac{g}{mL}$

Name _____

$V_{cylinder} = \pi r^2 h$ $\quad V_{(cube)} = l \times w \times h$ $\quad V_{(sphere)} = 4\pi r^3 \div 3$

1. An aluminum cylinder has a density of 2.98 g/cc. If its mass is 194.98 g and its height is 12.87 cm, what is its diameter?

$d = \frac{m}{V}$, $V = \frac{m}{d} = \frac{194.98\ g}{2.98\ g/cc} = 65.42953\ cc$

$V = \pi r^2 h$, $r^2 = \frac{V}{\pi h}$

$r = \sqrt{\frac{V}{\pi h}} = \sqrt{\frac{65.42953\ cm^3}{\pi (12.87\ cm)}}$

$r = 1.618\ldots\ cm$ $\quad d = 2 \times radius = 2.54\ cm$

2. If 98.54 grams of a liquid occupies 135.6 mL, what is the density of the liquid?

$d = \frac{m}{V} = \frac{98.54\ g}{135.6\ mL} = 0.7267\ \frac{g}{mL}$

3. A beaker can hold 615 mL of water when full. If you place 550 mL of water into the beaker and then add a metal cylinder with a diameter of 2.66 cm and a height of 13.06 cm, how many mL of water will overflow the beaker?

$V = \pi r^2 h = \pi (1.33\ cm)^2\ 13.06\ cm = 72.576\ldots\ cm^3$

$550\ mL + 72.576\ldots\ mL = 622.576\ldots\ mL$

$622.576\ mL - 615\ mL = 8\ mL$ will overflow

4. A metal ball has a density of 9.11 g/cc and a mass of 0.499 kg. If the ball is placed in a graduated cylinder that already contains 23.9 mL of water, what will be the final reading on the graduated cylinder?

$d = \frac{m}{V}$ $\quad V = \frac{m}{d} = \frac{499\ g}{9.11\ g/mL} = 54.774\ mL + 23.9\ mL$

$= 78.7\ mL$

5. A cylinder with a diameter of 2.7 cm and a mass of 45 grams has a density of 1.34 g/cm^3. What is the height of the cylinder?

$V = \pi r^2 h$

$h = \frac{V}{\pi r^2} = \frac{33.5820\ cm^3}{\pi (1.35\ cm)^2}$

$= 5.9\ cm$

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

$V = \frac{m}{d} = \frac{45\ g}{1.34\ g/cm^3}$

$= 33.5820\ cm^3$