

Density Practice Problems

1. An object has a volume of 825 cm^3 and a density of 13.6 g/cm^3 . Find its mass.

$$D = \frac{M}{V} \quad \frac{13.6 \text{ g}}{\text{cm}^3} = \frac{M}{825 \text{ cm}^3} \quad M = 11,220 \text{ g} \approx 11,200 \text{ g} \quad (3 \text{ sig figs})$$

2. What is the density of a gas when 14.28 g takes up 30.0 L of space?

$$D = \frac{M}{V} = \frac{14.28 \text{ g}}{30.0 \text{ L}} = 0.476 \text{ g/L} \quad (3 \text{ sig figs})$$

3. What is the mass of an object taking up 75 cm^3 of space and having a density of 2.2 g/cm^3 ?

$$D = \frac{M}{V} \quad \frac{2.2 \text{ g}}{\text{cm}^3} = \frac{M}{75 \text{ cm}^3} \quad M = 165 \text{ g} \approx 170 \text{ g} \quad (2 \text{ sig figs})$$

4. Gold has a density of 19.3 g/cm^3 . How much volume would 7.00 g of gold occupy?

$$D = \frac{M}{V} \quad \frac{19.3 \text{ g}}{\text{cm}^3} = \frac{7.00 \text{ g}}{V} \quad V = 0.363 \text{ cm}^3 \quad (3 \text{ sig figs})$$

5. A 44.00 g block has a measured volume of 35 cm^3 . What is its density?

$$D = \frac{M}{V} = \frac{44.00 \text{ g}}{35 \text{ cm}^3} = 1.3 \text{ g/cm}^3 \quad (2 \text{ sig figs})$$

6. 15.95 g of a substance has a density of 7.000 g/m^3 . How much space does it occupy?

$$D = \frac{M}{V} \quad \frac{7.000 \text{ g}}{\text{m}^3} = \frac{15.95 \text{ g}}{V} \quad V = 2.279 \text{ m}^3 \quad (4 \text{ sig figs})$$

7. Oxygen gas has a density of 1.33 g/L under normal conditions. What is the mass of 20.00 L of oxygen gas?

$$D = \frac{M}{V} \quad \frac{1.33 \text{ g}}{\text{L}} = \frac{M}{20.00 \text{ L}} \quad M = 26.6 \text{ g} \quad (3 \text{ sig figs})$$

8. A liquid has a density of 0.87 g/mL . What volume is occupied by 25 g of the liquid?

$$D = \frac{M}{V} \quad \frac{0.87 \text{ g}}{\text{mL}} = \frac{25 \text{ g}}{V} \quad V = 29 \text{ mL} \quad (2 \text{ sig figs})$$

9. An icicle is placed in 55.2 mL of ethanol so that it is completely submerged. The volume of the ethanol in the container increases to 70.6 mL before the icicle begins to melt. What is the mass of the icicle? (Use the density of ice = 0.915 g/cm^3 .)

$$\text{Volume of icicle} = 70.6 \text{ mL} - 55.2 \text{ mL} = 15.4 \text{ mL}$$

$$D = \frac{M}{V} \quad \frac{0.915 \text{ g}}{\text{cm}^3} = \frac{M}{15.4 \text{ mL}} \quad M = 14.1 \text{ g} \quad (3 \text{ sig figs})$$

Note: $1 \text{ cm}^3 = 1 \text{ mL}$

10. What is the mass of a cube of aluminum that is 3.0cm on each edge? The density of aluminum is 2.7g/cm³.

$$V = 3.0\text{cm} \times 3.0\text{cm} \times 3.0\text{cm} = 27\text{cm}^3$$

$$D = \frac{M}{V} \quad \frac{2.7\text{g}}{\text{cm}^3} = \frac{M}{27\text{cm}^3} \quad M = 72.9\text{g} \approx 73\text{g} \text{ (2 sig figs)}$$

Challenge Problems:

11. You are given a bottle that contains 4.59 cm³ of a metallic solid. The total mass of the bottle and the solid is 35.66g. The empty bottle weighs 14.23g. What is the density of the solid?

$$\text{Mass of solid} = 35.66\text{g} - 14.23\text{g} = 21.43\text{g}$$

$$D = \frac{M}{V} = \frac{21.43\text{g}}{4.59\text{cm}^3} = 4.67\text{g/cm}^3 \text{ (3 sig figs)}$$

12. The earth has a mass of approximately 5.99 x 10²⁴ kg and a radius of 6.38 x 10⁶ meters. Find the density of the earth in g/cm³.

$$5.99\text{kg} \times \frac{1000\text{g}}{1\text{kg}} = 5.99 \times 10^{27}\text{g}$$

$$V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi (6.38 \times 10^8\text{cm})^3 = 1.088 \times 10^{27}\text{cm}^3$$

$$D = \frac{M}{V} = \frac{5.99 \times 10^{27}\text{g}}{1.088 \times 10^{27}\text{cm}^3} = 5.51\text{g/cm}^3$$

$$6.38 \times 10^6\text{m} \times \frac{100\text{cm}}{1\text{m}} = 6.38 \times 10^8\text{cm}$$

13. A graduated cylinder was filled with water to the 15.0 mL mark. When placed on the balance the cylinder and water together had a mass of 27.35g. An object made of silver was placed in the water and became completely submerged. The water level rose to 18.3 mL. When reweighed, the cylinder, water, and silver had a mass of 62.00g. Calculate the density of the silver.

$$M = 62.00\text{g} - 27.35\text{g} = 34.65\text{g}$$

$$V = 18.3\text{mL} - 15.0\text{mL} = 3.3\text{mL}$$

$$D = \frac{M}{V} = \frac{34.65\text{g}}{3.3\text{mL}} =$$

$$D = 10.5\text{g/mL} \approx 11\text{g/mL} \text{ (2 sig figs)}$$