

AP Chemistry

Chapter 1 Supplemental Problems Key

1. Homogeneous, Heterogeneous, Heterogeneous, Homogeneous

- 2.
- a. orange = physical
 - b. turns to rust = chemical
 - c. explode = chemical
 - d. density = physical
 - e. melts = physical
 - f. green = physical

3. Physical, Chemical, Chemical, Chemical, Physical

4. One could check for an odor, check the boiling or freezing point, or determine the density. If the density is approximately 1g/cm^3 at room temperature, the liquid could be water. If it boils at about 100°C and freezes about 0°C , that would be consistent with water. To check for the presence of salt, boil the liquid away. If a substance remains, it could be a salt, but further testing would be required.

5. a. Qualitative = blue-green, solid

Quantitative = 2.65g/cm^3 and 2.5g

b. Extensive = 2.5g

Intensive = blue-green, solid, and 2.65g/cm^3

c. $V = 2.5\text{g} / 2.65\text{g/cm}^3 = .94\text{cm}^3$

6. $D = m/V$

$= 23.5\text{g} / (52.2\text{mL} - 47.5\text{mL})$

$= 23.5\text{g} / 4.7\text{mL} = \mathbf{5.0\text{g/mL}}$

$$7. \text{ } ^\circ\text{F} = 9/5 (37^\circ\text{C}) + 32 = 98.6 = \mathbf{99^\circ\text{F}}$$

$$^\circ\text{C} = 5/9 (98.2 - 32) = \mathbf{36.8^\circ\text{C}}$$

8. 4, 2, 5, 3, 4, 4

9. a. 37.8 m

b. 2.4 cm

c. 73.0 mm x 1.340 mm x (25.31 mm - 1.6 mm)
{ 23.7 mm}

$$= 2318.234 = \mathbf{2.32 \times 10^3 \text{ mm}^3}$$

$$d. \frac{2.023 \text{ g} - 1.8 \times 10^{-3} \text{ g}}{1.05 \times 10^4 \text{ mL}} = 2.021 \text{ g} / 1.05 \times 10^4 \text{ mL} = \mathbf{1.92 \times 10^{-4} \text{ g/mL}}$$

10. The result would be $12.108 \text{ g} - 12.024 \text{ g} = \mathbf{.084 \text{ g}}$ You can see because of the rules of addition/subtraction, even though each measurement had 5 significant digits, the final answer only contains **2 significant digits**.

$$11. (0.50 \text{ mL})(1.0 \text{ g/mL})(.10)(1,000 \text{ mg/1g}) = \mathbf{50. \text{ mg}}$$

$$12. (1.50 \text{ carat})(0.200 \text{ g/carat})(1 \text{ cm}^3/3.513 \text{ g}) = .085397... = \mathbf{8.54 \times 10^{-2} \text{ cm}^3}$$

$$13. 5.79 \text{ mg} (1 \text{ g} / 1,000 \text{ mg}) = 5.79 \times 10^{-3} \text{ g} (1 \text{ cm}^3 / 19.3 \text{ g}) \\ = 3.00 \times 10^{-4} \text{ cm}^3 / 44.6 \text{ cm}^2 = \mathbf{6.73 \times 10^{-6} \text{ cm}}$$

14. a. $100. \text{ lb} (.4536) = 45.36 \text{ kg} (1,000 \text{ g}/1 \text{ kg}) = 4.536 \times 10^4 \text{ g}$
 b. $15. \text{ Gal} (3.7854) = 56.781 \text{ L} (1,000 \text{ L}/1 \text{ L}) = 5.6781 \times 10^4 \text{ g}$
 c. $3.0 \text{ L} (1,000 \text{ mL}/1 \text{ L}) = 3.0 \times 10^3 \text{ mL} (13.6 \text{ g}/1 \text{ mL}) = 4.080 \times 10^4 \text{ g}$

Water would be the heaviest.

15. $10.8 \text{ mL water displaced} = 10.8 \text{ g water displaced} = 10.8 \text{ g of wooden block}$

$$V = (1.0 \text{ in})(1.0 \text{ in})(1.0 \text{ in}) = 1.0 \text{ in}^3 (2.54 \text{ cm} / 1 \text{ in})^3 = 16.39 \text{ cm}^3 (2 \text{ sig figs})$$

$$D = m/V = 10.8 \text{ g} / 16.39 \text{ cm}^3 = .659 \text{ g/cm}^3 = \mathbf{.66 \text{ g/cm}^3}$$

16. $125 \text{ cm}^3 \text{ powder} (2.2 \text{ g}/1 \text{ cm}^3) = 275 \text{ g powder} = 275 \text{ g aerogel} (1 \text{ cm}^3 / .015 \text{ g})$
 $= \mathbf{1.8 \times 10^4 \text{ cm}^3}$ (= volume of aerogel)

17. Brass: $V = (2.0 \text{ cm})^3 = 8.0 \text{ cm}^3$ Brass sinks so it displaces 8.0 cm^3 of water.

Cork: $V = (5.0 \text{ cm})(4.0 \text{ cm})(2.0 \text{ cm}) = 40. \text{ cm}^3 (.22 \text{ g}/1 \text{ cm}^3) = 8.8 \text{ g Cork}$

$8.8 \text{ g water} (1 \text{ cm}^3/1 \text{ g}) = 8.8 \text{ cm}^3 \text{ water}$

The cork displaces more water than the brass

18. $(7682 \text{ L})(1.77 \text{ lb/L}) = 13,597.14 \text{ lbs}$ (Not kg as they assumed)

$(.803 \text{ kg/L})(7682 \text{ L}) = 6168.646 \text{ kg left}$

$22,300 \text{ kg} - 6168.646 \text{ kg} = \mathbf{16131.354 \text{ kg} (1.61 \times 10^4 \text{ kg})}$ or $\mathbf{20,089 \text{ L} (2.01 \times 10^4 \text{ L})}$
needed.