

Chapter 1 - Chemistry: Matter and Measurement

Text Problems: 5, 8, 15, 17, 24, 29, 31, 37, 39, 47, 61, 65, 75, 76, 80, 81, 90, 97, 101, 107

- 1.5 (a) NaCl is a compound; sodium is an element
(b) Sugar is a compound; carbon is an element.
(c) Gold chloride is a compound; gold is an element.

- 1.8 (a) chemical change
(b) physical change
(c) chemical change
(d) physical change

$$1.15 \quad \frac{37.5 \text{ g}}{(20.2 - 6.9) \text{ mL}} \cdot \frac{1 \text{ mL}}{1 \text{ cm}^3} = 2.82 \text{ g/cm}^3$$

The sample's density matches that of aluminum.

$$1.17 \quad (25 \text{ }^\circ\text{C} + 273.15 \text{ }^\circ\text{C}) \frac{1 \text{ K}}{1 \text{ }^\circ\text{C}} = 298 \text{ K}$$

$$1.24 \quad \text{Area} = \pi r^2 = \pi \left(\frac{11.8 \text{ cm}}{2} \right)^2 = 109 \text{ cm}^2$$

$$109 \text{ cm}^2 \cdot \left(\frac{1 \text{ m}}{100 \text{ cm}} \right)^2 = 1.09 \times 10^{-2} \text{ m}^2$$

1.29	Method A	Deviation	Method B	Deviation
	2.2	0.2	2.703	0.777
	2.3	0.1	2.701	0.779
	2.7	0.3	2.705	0.775
	2.4	0.0	5.811	2.331
(a) Average:	2.4	0.2	3.480	1.166

For method B the reading of 5.811 can be excluded because it is more than twice as large as all other readings. Using only the first three readings, average = 2.703 g/cm³ and average deviation = 0.001 g/cm³.

$$(b) \text{ Method A: Percent error} = \frac{2.702 - 2.4}{2.702} \times 100\% = 10\%$$

$$\text{Method B: Percent error} = \frac{2.703 - 2.702}{2.702} \times 100\% = 0.04\% \text{ (omitting data point)}$$

- (c) Before excluding a data point for B, method A is more accurate and more precise. After excluding data for B, this method gives a more accurate and more precise result.

- 1.31 (a) Qualitative observations: blue-green color, solid physical state
 Quantitative observations: density of 2.65 g/cm^3 , mass of 2.5 g, length of 4.6 cm
 (b) Mass and length are extensive properties, color, physical state, and density are intensive properties
 (c) $2.5 \text{ g} \cdot \frac{1 \text{ cm}^3}{2.65 \text{ g}} = 0.94 \text{ cm}^3$

1.37 $1.97 \text{ \AA} \cdot \frac{10^{-10} \text{ m}}{1 \text{ \AA}} \cdot \frac{1 \text{ nm}}{10^{-9} \text{ m}} = 0.197 \text{ nm}$
 $1.97 \text{ \AA} \cdot \frac{10^{-10} \text{ m}}{1 \text{ \AA}} \cdot \frac{1 \text{ pm}}{10^{-12} \text{ m}} = 197 \text{ pm}$

1.39 (a) $7.5 \text{ \mu m} \cdot \frac{10^{-6} \text{ m}}{1 \text{ \mu m}} = 7.5 \times 10^{-6} \text{ m}$
 (b) $7.5 \times 10^{-6} \text{ m} \cdot \frac{1 \text{ nm}}{10^{-9} \text{ m}} = 7.5 \times 10^3 \text{ nm}$
 (c) $7.5 \times 10^{-6} \text{ m} \cdot \frac{1 \text{ pm}}{10^{-12} \text{ m}} = 7.5 \times 10^6 \text{ pm}$

1.47 $\frac{67 \text{ g}}{(26.0 - 22.5) \text{ mL}} \cdot \frac{1 \text{ mL}}{1 \text{ cm}^3} = 19 \text{ g/cm}^3$

The necklace's density matches that of gold. The necklace contains more than 2 troy ounces of gold, so \$300 is a good price.

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

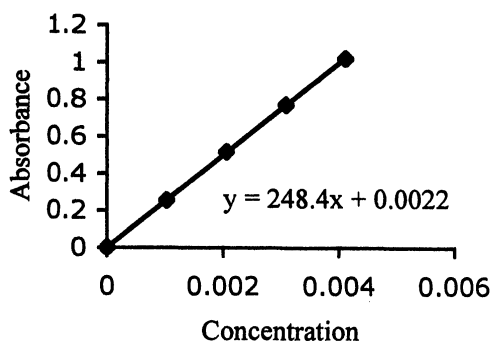
- 1.65 (a) Solid potassium reacts with liquid water to produce gaseous hydrogen and a homogeneous mixture of potassium hydroxide in liquid water.
 (b) The reaction is a chemical change.
 (c) Potassium and water are reactants, hydrogen and potassium hydroxide are products.
 (d) Among the qualitative observations are (i) the reaction is violent; and (ii) heat and light (a purple flame) are produced.

1.75 (a) 9.44×10^{-3} (b) 5.69×10^3 (c) 11.9

1.76 2.44×10^8 (b) 4.85×10^{-2} (c) 0.133

1.80 0.0286

1.81



$$\text{slope} = 248.4$$

$$0.635 = (248.4)(\text{concentration}) + 0.0022$$

$$\text{concentration} = 2.548 \times 10^{-3}$$

- 1.90 (a) $\text{Volume} = (0.563 \text{ nm})^3 = 0.178 \text{ nm}^3$
 $0.178 \text{ nm}^3 \cdot \left(\frac{10^{-9} \text{ m}}{1 \text{ nm}}\right)^3 \cdot \left(\frac{100 \text{ cm}}{1 \text{ m}}\right)^3 = 1.78 \times 10^{-22} \text{ cm}^3$
- (b) $\frac{2.17 \text{ g}}{1 \text{ cm}^3} \cdot 1.78 \times 10^{-22} \text{ cm}^3 = 3.86 \times 10^{-22} \text{ g}$
- (c) $\frac{3.86 \times 10^{-22} \text{ g}}{4 \text{ NaCl formula units}} = 9.65 \times 10^{-23} \text{ g/formula unit}$

1.97 $0.5 \text{ acre} \cdot \frac{1.0 \times 10^4 \text{ m}^2}{2.47 \text{ acres}} \left(\frac{100 \text{ cm}}{1 \text{ m}}\right)^2 = 2 \times 10^7 \text{ cm}^2$

$$\text{thickness} = \frac{\text{volume}}{\text{area}} = \frac{5 \text{ cm}^3}{2 \times 10^7 \text{ cm}^2} = 2 \times 10^{-7} \text{ cm}$$

This is likely related to the "length" of oil molecules.

1.101 $279 \text{ kg} \cdot \frac{10^3 \text{ g}}{1 \text{ kg}} \cdot \frac{1 \text{ cm}^3}{19.3 \text{ g}} = 1.45 \times 10^4 \text{ cm}^3$

$$\text{volume} = (\text{area})(\text{thickness})$$

$$1.45 \times 10^4 \text{ cm}^3 = (\text{area}) \left(0.0015 \text{ mm} \cdot \frac{1 \text{ cm}}{10 \text{ mm}}\right)$$

$$\text{area} = 9.6 \times 10^7 \text{ cm}^2 \cdot \left(\frac{1 \text{ m}}{100 \text{ cm}}\right)^2 = 9.6 \times 10^3 \text{ m}^2$$

1.107 (a) $\text{density} = \frac{0.9360 \text{ g}}{7.50 \times 10^2 \text{ mL}} \cdot \frac{10^3 \text{ mL}}{1 \text{ L}} = 1.25 \text{ g/L}$

(b) The gas could be N_2 , C_2H_4 , or CO .

(c) $\text{density} = \frac{0.9360 \text{ g}}{7.496 \times 10^2 \text{ mL}} \cdot \frac{10^3 \text{ mL}}{1 \text{ L}} = 1.249 \text{ g/L}$

The gas could be N_2 or CO .