

Chapter 1

Review Questions

- 1.1 This answer will be student dependent.
- 1.5 Physical properties are characteristic properties possessed by substances. A physical property can be measured and used to characterize a pure substance without reference to other substances. A chemical property governs the reactivity of a substance either with other substances or to give other substances. Intensive properties are independent of sample size. Extensive properties depend on sample size. Boiling point and color are physical properties. Rusting (oxidation) and reaction with water are chemical properties. Color and electrical conductivity are intensive properties. Mass and volume are extensive properties.
- 1.7 These are physical changes.
- 1.9
- (a) An element is a pure substance that cannot be decomposed into something simpler.
 - (b) A compound is a pure substance that is composed of two or more elements in some fixed or characteristic proportion.
 - (c) Mixtures result from combinations of pure substances in varying proportions.
 - (d) A homogeneous mixture has one phase. It has the same properties throughout the sample.
 - (e) A heterogeneous mixture has more than one phase. The different phases have different properties.
 - (f) A phase is a region of a mixture that has properties that are different from other regions of the mixture.
 - (g) A solution is a homogeneous mixture.
- 1.10
- | | | | |
|--------|--------|--------|--------|
| (a) Cl | (b) S | (c) Fe | (d) Ag |
| (e) Na | (f) P | (g) I | (h) Cu |
| (i) Hg | (j) Ca | | |
- 1.11
- | | | | |
|---------------|---------------|-------------|--------------|
| (a) potassium | (b) zinc | (c) silicon | (d) tin |
| (e) manganese | (f) magnesium | (g) nickel | (h) aluminum |
| (i) carbon | (j) nitrogen | | |
- 1.18 The digits that are significant figures in a quantity are those that are known (measured) with certainty plus the last digit, which contains some uncertainty.
- 1.19 The *accuracy* of a measured value is the closeness of that value to the true value of the quantity. The *precision* of a number of repeated measurements of the same quantity is the closeness of the measurements to one another.
- 1.23 Four significant figures would be correct because the conversion factor contains exact values. The measured value determines the number of significant figures.
- 1.28
- (e) $T_K = (t_C + 273\text{ }^\circ\text{C})$ and the= $60 + 273 = 333\text{ K}$
 - (f) $T_K = (t_C + 273\text{ }^\circ\text{C})\left(\frac{1\text{ K}}{1\text{ }^\circ\text{C}}\right) = -30 + 273 = 243\text{ K}$
- 1.35 Convert 6000 K to t_C :
- $$t_C = (T_K - 273\text{ K})\left(\frac{1\text{ }^\circ\text{C}}{1\text{ K}}\right) = (6000\text{ K} - 273\text{ K})\left(\frac{1\text{ }^\circ\text{C}}{1\text{ K}}\right) = 5700\text{ }^\circ\text{C}$$
- This is hot enough to melt concrete, since it is hotter than $2000\text{ }^\circ\text{C}$.
- 1.37
- | | |
|---------------------------|---------------------------|
| (a) 3 significant figures | (d) 5 significant figures |
| (b) 6 significant figures | (e) 1 significant figures |
| (c) 1 significant figures | (f) 5 significant figures |

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- 1.39 (a) 2.06 g/mL (d) 0.276 g/mL
 (b) 4.02 mL (e) 0.0006 m/s
 (c) 12.4 g/mL

1.41 (a) $\mu\text{m}^3 = (92 \text{ dL}) \left(\frac{1 \text{ L}}{10 \text{ dL}} \right) \left(\frac{1000 \text{ cm}^3}{1 \text{ L}} \right) \left(\frac{1 \text{ m}}{100 \text{ cm}} \right)^3 \left(\frac{10^6 \mu\text{m}}{1 \text{ m}} \right)^3 = 9.2 \times 10^{15} \mu\text{m}^3$

(b) $\mu\text{g} = (22 \text{ ng}) \left(\frac{1 \text{ g}}{10^9 \text{ ng}} \right) \left(\frac{10^6 \mu\text{g}}{1 \text{ g}} \right) = 0.022 \mu\text{g}$

(c) $\text{nL} = (83 \text{ pL}) \left(\frac{1 \text{ L}}{10^{12} \text{ pL}} \right) \left(\frac{10^9 \text{ nL}}{1 \text{ L}} \right) = 0.083 \text{ nL}$

(d) $\text{m}^3 = (230 \text{ km}^3) \left(\frac{1000 \text{ m}}{1 \text{ km}} \right)^3 = 2.3 \times 10^{11} \text{ m}^3$

(e) $\text{km hr}^{-2} = (87.3 \text{ cm s}^{-2}) \left(\frac{1 \text{ m}}{100 \text{ cm}} \right) \left(\frac{1 \text{ km}}{1000 \text{ m}} \right) \left(\frac{3600 \text{ s}}{1 \text{ hr}} \right)^2 = 1.13 \times 10^4 \text{ km hr}^{-2}$

(f) $\text{nm}^2 = (238 \text{ mm}^2) \left(\frac{1 \text{ m}}{1000 \text{ mm}} \right)^2 \left(\frac{1 \text{ nm}}{10^{-9} \text{ m}} \right)^2 = 2.38 \times 10^{14} \text{ nm}^2$

1.43 (a) $\text{qt} = (250 \text{ mL}) \left(\frac{1 \text{ qt}}{946.4 \text{ mL}} \right) = 0.26 \text{ qt}$

(b) $\text{m} = (3.0 \text{ ft}) \left(\frac{12 \text{ in.}}{1 \text{ ft}} \right) \left(\frac{2.54 \text{ cm}}{1 \text{ in.}} \right) \left(\frac{1 \text{ m}}{100 \text{ cm}} \right) = 0.91 \text{ m}$

(c) $\text{lb} = (1.62 \text{ kg}) \left(\frac{2.205 \text{ lb}}{1 \text{ kg}} \right) = 3.57 \text{ lb}$

(d) $\text{oz} = (1.75 \text{ L}) \left(\frac{1000 \text{ mL}}{1 \text{ L}} \right) \left(\frac{1 \text{ oz}}{29.6 \text{ mL}} \right) = 59.1 \text{ oz}$

(e) $\text{mi/hr} = (35 \text{ km/hr}) \left(\frac{1 \text{ mi}}{1.609 \text{ km}} \right) = 22 \text{ mi/hr}$

(f) $\text{mi} = (80.0 \text{ km}) \left(\frac{1 \text{ mi}}{1.609 \text{ km}} \right) = 49.7 \text{ mi}$

1.45 (a) $\text{m}^2 = (2.4 \text{ yd}^2) \left(\frac{0.9144 \text{ m}}{1 \text{ yd}} \right)^2 = 2.0 \text{ m}^2$

(b) $\text{mm}^2 = (8.3 \text{ in}^2) \left(\frac{2.54 \text{ cm}}{1 \text{ in}} \right)^2 \left(\frac{10 \text{ mm}}{1 \text{ cm}} \right)^2 = 5400 \text{ mm}^2$

(c) $\text{L} = (9.1 \text{ ft}^3) \left(\frac{1 \text{ yd}}{3 \text{ ft}} \right)^3 \left(\frac{0.9144 \text{ m}}{1 \text{ yd}} \right)^3 \left(\frac{100 \text{ cm}}{1 \text{ m}} \right)^3 \left(\frac{1 \text{ mL}}{1 \text{ cm}^3} \right) \left(\frac{1 \text{ L}}{1000 \text{ mL}} \right) = 260 \text{ L}$

1.48 $\frac{\text{m}}{\text{s}} = \left(\frac{200 \text{ mi}}{1 \text{ hr}} \right) \left(\frac{5280 \text{ ft}}{1 \text{ mi}} \right) \left(\frac{30.48 \text{ cm}}{1 \text{ ft}} \right) \left(\frac{1 \times 10^{-2} \text{ m}}{1 \text{ cm}} \right) \left(\frac{1 \text{ hr}}{60 \text{ min}} \right) \left(\frac{1 \text{ min}}{60 \text{ s}} \right) = 90 \frac{\text{m}}{\text{s}}$

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$$1.54 \quad \text{meters} = 6033.5 \text{ fathoms} \left(\frac{6 \text{ ft}}{1 \text{ fathom}} \right) \left(\frac{1 \text{ yd}}{3 \text{ ft}} \right) \left(\frac{0.9144 \text{ m}}{1 \text{ yd}} \right) = 11,034 \text{ m}$$

$$1.57 \quad \text{density} = \frac{\text{mass}}{\text{volume}} \quad d = \frac{14.3 \text{ g}}{8.46 \text{ cm}^3} = 1.69 \text{ g/cm}^3$$

$$1.61 \quad \text{kg} = (34 \text{ L}) \left(\frac{1000 \text{ mL}}{1 \text{ L}} \right) \left(\frac{0.65 \text{ g}}{1 \text{ mL}} \right) \left(\frac{1 \text{ kg}}{1000 \text{ g}} \right) = 22 \text{ kg}$$

$$\text{lbs} = (22 \text{ kg}) \left(\frac{2.2 \text{ lbs}}{1 \text{ kg}} \right) = 48 \text{ lbs}$$