HW #1-1 CHAPTER 1 (SUMMER ASSIGNMENT)

PROBLEMS, pg. 32 # 11, 12, 15, 16, 18, 21, 22, 28, 33, 35, 36, 37, 39, 41, 49, 54, 79, 81, 83, 85

1.11 Do the following statements describe chemical or physical properties?

- **(a) Oxygen gas supports combustion.** Chemical property. Oxygen gas is consumed in a combustion reaction; its composition and identity are changed.
- **(b) Fertilizers help to increase agricultural production.** Chemical property. The fertilizer is consumed by the growing plants; it is turned into vegetable matter (different composition).
- **(c) Water boils below 100°C on top of a mountain.** Physical property. The measurement of the boiling point of water does not change its identity or composition.
- **(d) Lead is denser than aluminum.** Physical property. The measurement of the densities of lead and aluminum does not change their composition.
- **(e) Uranium is a radioactive element.** Nuclear property. When uranium undergoes nuclear decay, the products are chemically different substances.

1.12 Does each of the following describe a physical change or a chemical change?

- **(a) The helium gas inside a balloon tends to leak out after a few hours.** Physical change. The helium isn't changed in any way by leaking out of the balloon.
- **(b) A flashlight beam slowly gets dimmer and finally goes out.** Chemical change in the battery.
- **(c) Frozen orange juice is reconstituted by adding water to it.** Physical change. The orange juice concentrate can be regenerated by evaporation of the water.
- **(d) The growth of plants depends on the sun's energy in a process called photosynthesis.** Chemical change. Photosynthesis changes water, carbon dioxide, etc., into complex organic matter.
- **(e) A spoonful of table salt dissolves in a bowl of soup.** Physical change. The salt can be recovered unchanged by evaporation.

1.15 Classify each of the following substances as an element or a compound:

(a) hydrogen: element **(b) water:** compound **(c) gold:** element **(d) sugar:** compound

1.16 Classify each of the following as an element, a compound, or a heterogeneous or homogeneous mixture:

- **(a) seawater:** homogeneous mixture
- **(b) helium gas:** element
- **(c) sodium chloride:** compound
- **(d) soft drink:** homogeneous mixture
- **(e) milkshake:** heterogeneous mixture
- **(f) air:** homogeneous mixture
- **(g) concrete:** heterogeneous mixture

1.18 Write the numbers represented by the following prefixes:

- **(a) mega:** 10^{6}
- **(b) kilo:** 10^{3}
- **(c) deci:** 10^{-1}
- **(d) centi:** 10^{-2}
- **(e) milli:** 10^{-3}
- **(f) micro** (μ): 10^{-6}
- **(g) nano:** 10^{-9}
- **(h) pico:** 10^{-12}

1.21 $$\textbf{density} = \frac{\text{mass}}{\text{volume}} = \frac{586\text{ g}}{188\text{ mL}} = 3.1170 = \boxed{\textbf{3.12 g / mL}}\ \text{(3 sf)}$$

1.22 $$\text{density} = \frac{\text{mass}}{\text{volume}} \text{ so } \textbf{mass} = \text{volume} \times \text{density}$$

$$\textbf{mass of ethanol} = 17.4\text{ mL} \times \frac{0.798\text{ g}}{1\text{ mL}} = 13.8852 = \boxed{\textbf{13.9 g}}\ \text{(3 sf)}$$

1.28 A significant figure is one that can be certain or reasonably certain to be correct. In measurements, significant figures indicate the precision of the equipment: all certain digits plus a final estimate, or one more digit than given by the markings. Use of proper significant figures is important to convey the precision of one's measurements and/or calculations.

1.33 **What is the number of significant figures in each of the following measurements?**
(a) 4867 mi: four **(b)** 56 mL: two **(c)** 60,104 ton: five **(d)** 2900 g: two, three, or four
(e) 40.2 g/cm^3: three **(f)** 0.0000003 cm: one **(g)** 0.7 min: one **(h)** 4.6×10^{19} atoms: two

1.35 **(a)** 5.6792 m + 0.6 m + 4.33 m = 10.6 m
(b) 3.70 g – 2.9133 g = 0.79 g
(c) 4.51 cm × 3.6666 cm = 16.5 cm^2

$$\begin{array}{r} 5.6792\text{ m} \\ 0.6\text{ m} \\ \underline{4.33\text{ m}} \\ 10.6092\text{ m} \end{array}$$

1.36 **(a)** $\dfrac{7.310\text{ km}}{5.70\text{ km}} = 1.283 = \boxed{1.28}$ (3 sf) (Why are there no units?)

(b)

$$\begin{array}{r} 0.00326\text{ mg} \\ \underline{-\,0.0000788\text{ mg}} \\ 0.0031812\text{ mg} \end{array} \qquad \mathbf{0.00318\ mg = 3.18\times10^{-3}\ mg}\ (10^{-5}\text{ place})$$

(c) $(0.402\times10^{7}\text{ dm}) + (7.74\times10^{7}\text{ dm}) = \mathbf{8.14\times10^{7}\ dm}\ (10^{5}\text{ place})$

1.37 **(a)** $\mathbf{?\ dm} = 22.6\text{ m}\times\dfrac{1\text{ dm}}{0.1\text{ m}} = \boxed{\mathbf{226\ dm}}$ (3 sf)

(b) $\mathbf{?\ kg} = 25.4\text{ mg}\times\dfrac{1\times10^{-3}\text{ g}}{1\text{ mg}}\times\dfrac{1\text{ kg}}{1000\text{ g}} = \boxed{\mathbf{2.54\times10^{-5}\ kg}}$ (3 sf)

(c) $\mathbf{?\ L} = 556\text{ mL}\times\dfrac{1\times10^{-3}\text{ L}}{1\text{ mL}} = \boxed{\mathbf{0.556\ L}}$ (3 sf)

(d) $\mathbf{?\ \dfrac{g}{cm^3}} = \dfrac{10.6\text{ kg}}{1\text{ m}^3}\times\dfrac{1000\text{ g}}{1\text{ kg}}\times\left(\dfrac{1\times10^{-2}\text{ m}}{1\text{ cm}}\right)^3 = \boxed{\mathbf{0.0106\ g/cm^3}}$ (3 sf)

1.39 $\dfrac{1255\text{ m}}{1\text{ s}}\times\dfrac{1\text{ mi}}{1609\text{ m}}\times\dfrac{3600\text{ s}}{1\text{ h}} = 2807.96 = \boxed{\mathbf{2808\ mi/h}}$ (4 sf)

1.41 $93\times10^{6}\text{ mi}\times\dfrac{1.609\text{ km}}{1\text{ mi}}\times\dfrac{1000\text{ m}}{1\text{ km}}\times\dfrac{1\text{ s}}{3.00\times10^{8}\text{ m}}\times\dfrac{1\text{ min}}{60\text{ s}} = 8.313 = \boxed{\mathbf{8.3\ min}}$ (2 sf)

1.49 $\mathbf{density} = \dfrac{2.70\text{ g}}{1\text{ cm}^3}\times\dfrac{1\text{ kg}}{1000\text{ g}}\times\left(\dfrac{1\text{ cm}}{1\times10^{-2}\text{ m}}\right)^3 = 2700 = \boxed{\mathbf{2.70\times10^{3}\ kg/m^3}}$

1.54 $\mathbf{density} = \dfrac{\boldsymbol{m}}{\boldsymbol{V}} = \dfrac{\boldsymbol{m}}{\boldsymbol{length\times width\times height}} = \dfrac{52.7064\text{ g}}{(8.53\text{ cm})(2.4\text{ cm})(1.0\text{ cm})} = \boxed{\mathbf{2.6\ g/cm^3}}$

1.79 Chalcopyrite, the principal ore of copper (Cu), contains 34.63 percent Cu by mass. How many grams of Cu can be obtained from 5.11×10^3 kg of the ore?

$$\textbf{? g Cu} = \underline{5.11} \times 10^3 \text{ kg ore} \times \frac{34.63\% \text{ Cu}}{100\% \text{ ore}} \times \frac{1000 \text{ g}}{1 \text{ kg}} = \underline{1.76}95 \times 10^6 = \boxed{\mathbf{1.77 \times 10^6 \text{ g Cu}}}$$

1.81 A 1.0 mL volume of seawater contains about 4.0×10^{-12} g of gold. The total volume of ocean water is 1.5×10^{21} L. Calculate the total amount of gold (in grams) that is present in seawater, and the worth of the gold in dollars (See problem 1.80). With so much gold out there, why hasn't someone become rich by mining gold from the ocean?

$$\textbf{? g Au} = \underline{1.5} \times 10^{21} \text{ L seawater} \times \frac{1 \text{ mL}}{0.001 \text{ L}} \times \frac{\underline{4.0} \times 10^{-12} \text{ g Au}}{1 \text{ mL seawater}} = \boxed{\mathbf{6.0 \times 10^{12} \text{ g Au}}}$$

$$\textbf{value of gold} = \underline{6.0} \times 10^{12} \text{ g Au} \times \frac{1 \text{ lb}}{453.6 \text{ g}} \times \frac{16 \text{ oz}}{1 \text{ lb}} \times \frac{\$350}{1 \text{ oz}} = \underline{7.4}07 \times 10^{13} = \boxed{\mathbf{\$7.4 \times 10^{13}}}$$

No one has become rich mining gold from the ocean, because the cost of recovering the gold would outweigh the price of the gold.

1.83 The thin outer layer of Earth, called the crust, contains only 0.50 percent of Earth's total mass and yet is the source of almost all the element (the atmosphere provides elements such as oxygen, nitrogen and a few other gases) Silicon (Si) is the second most abundant element in Earth's crust (27.2 percent by mass). Calculate the mass of silicon in kilograms in Earth's crust. (The mass of Earth is 5.9×10^{21} tons. 1 ton = 2000 lbs; 1 lb = 453.6 g)

$$\text{mass of Earth's crust} = \underline{5.9} \times 10^{21} \text{ tons earth} \times \frac{0.\underline{50}\% \text{ crust}}{100\% \text{ Earth}} = 2.95 \times 10^{19} \text{ tons crust (1 extra SF)}$$

$$\textbf{mass Si in crust} = 2.95 \times 10^{19} \text{ tons crust} \times \frac{27.2\% \text{ Si}}{100\% \text{ crust}} \times \frac{2000 \text{ lb}}{1 \text{ ton}} \times \frac{1 \text{ kg}}{2.205 \text{ lb}} = \underline{7.2}78 \times 10^{21} = \boxed{\mathbf{7.3 \times 10^{21} \text{ kg Si}}}$$

1.85 One gallon of gasoline in an automobile's engine produces on the average 9.5 kg of carbon dioxide, which is a greenhouse gas, that is, it promotes the warming of Earth's atmosphere. Calculate the annual production of carbon dioxide in kilograms if there are 40 million cars in the United States and each car covers a distance of 5000 mi at a consumption rate of 20 miles per gallon.

$$40 \times 10^6 \text{ cars} \times \frac{5000 \text{ mi}}{1 \text{ car}} \times \frac{1 \text{ gal gas}}{20 \text{ mi}} \times \frac{9.5 \text{ kg } CO_2}{1 \text{ gal gas}} = \boxed{\mathbf{9.5 \times 10^{10} \text{ kg } CO_2}} \text{ (assume 2 sf)}$$