WKS #1-2: Review Chapter 1 **Name** Answer Key

Problems from pp. 33-36 #1.26, 1.48, 1.52, 1.69, 1.88, 1.92

For calculations, show all work and express your answers to the correct number of sig figs.

1.26 Convert the following temperatures to °C:

(a) 77 K $°C = K - 273 = 77\ K - 273 = \mathbf{-196°C}$

(b) 4.2 K $°C = 4.2\ K - 273 = \mathbf{-269°C}$

(c) 601 K $°C = 601\ K - 273 = \mathbf{328°C}$

1.48 Perform the following conversions:

(a) 185 nm to m $? \text{ m} = 185 \text{ nm} \times \frac{1 \times 10^{-9} \text{ m}}{1 \text{ nm}} = \boxed{\mathbf{1.85 \times 10^{-7} \text{ m}}}$

(b) 4.5×10^9 yr to s $? \text{ s} = 4.5 \times 10^9 \text{ yr} \times \frac{365 \text{ day}}{1 \text{ yr}} \times \frac{24 \text{ h}}{1 \text{ day}} \times \frac{3600 \text{ s}}{1 \text{ h}} = \boxed{\mathbf{1.4 \times 10^{17} \text{ s}}}$

(c) 71.2 cm^3 to m^3 $? \text{ m}^3 = 71.2 \text{ cm}^3 \times \left(\frac{0.01 \text{ m}}{1 \text{ cm}} \right)^3 = \boxed{\mathbf{7.12 \times 10^{-5} \text{ m}^3}}$

(d) 88.6 m^3 to L $? \text{ L} = 88.6 \text{ m}^3 \times \left(\frac{1 \text{ cm}}{1 \times 10^{-2} \text{ m}} \right)^3 \times \frac{1 \text{ L}}{1000 \text{ cm}^3} = \boxed{\mathbf{8.86 \times 10^4 \text{ L}}}$

1.52 Which of the following statements describe physical properties and which describe chemical properties? Explain

(a) Iron has a tendency to rust.
Chemical property. Iron has changed its composition and identity by chemically combining with oxygen and water.

(b) Rainwater in industrialized regions tends to be acidic.
Chemical property. The water reacts with chemicals in the air (such as sulfur dioxide) to produce acids, thus changing the composition and identity of the water.

(c) Hemoglobin molecules have a red color.
Physical property. The color of the hemoglobin can be observed and measured without changing its composition or identity.

(d) When a glass of water is left out in the sun, the water gradually disappears.
Physical property. The evaporation of water does not change its chemical properties. Evaporation is a change in matter from the liquid state to the gaseous state.

(d) Carbon dioxide in air is converted to more complex molecules by plants during photosynthesis.
Chemical property. The CO_2 is converted into new substances.

1.69 **The total volume of seawater on earth is 1.5×10^{21} L. Assume that seawater contains 3.1% sodium chloride by mass and that its density is 1.03 g/mL. Calculate the total mass of sodium chloride in the sea, in kilograms.**

$$1.5\times10^{21}\text{ L}\times\frac{1\text{ mL}}{0.001\text{ L}}\times\frac{1.03\text{ g}}{1\text{ mL}}\times\frac{3.1\text{ g NaCl}}{100\text{ g seawater}}\times\frac{1\text{ kg}}{1\times10^{3}\text{ g}}=4.790\times10^{19}=\boxed{\mathbf{4.8\times10^{19}\text{ kg NaCl}}}$$

1.88 **Sodium hypochlorite (NaOCl) is used to disinfect swimming pools. The ideal concentration for this purpose is 1 ppm chlorine (1 g NaOCl per 1×10^{6} grams of H_2O). Calculate the volume of NaOCl solution (in mL) a homeowner should add to her swimming pool if the solution contains 6.0 % NaOCl by mass and there are 2.0×10^{4} gallons of water in the pool.**

1 gallon = 3.79 L density of liquids = 1.0 g/mL

$$2.0\times10^{4}\text{ gallons }H_2O\times\frac{3.79\text{ L}}{1\text{ gallon}}\times\frac{1\text{ mL}}{0.001\text{ L}}\times\frac{1\text{ g}}{1\text{ mL}}=7.6\times10^{7}\text{ g }H_2O$$

$$7.6\times10^{7}\text{ g }H_2O\times\frac{1\text{ g NaOCl}}{1\times10^{6}\text{ g }H_2O}=76\text{ g NaOCl}$$

$$76\text{ g NaOCl}\times\frac{100\%\text{ soln}}{6\%\text{ NaOCl}}\times\frac{1\text{ mL soln}}{1\text{ g soln}}=\boxed{\mathbf{1.3\times10^{3}\text{ mL of NaOCl solution (1.3 L)}}}$$

1.92 **A gas company charges \$1.30 for 15.0 ft^3 of natural gas.**

(a) Convert this rate to dollars per liter of gas.

$$\frac{\$1.30}{15.0\text{ ft}^3}\times\left(\frac{1\text{ ft}}{12\text{ in}}\right)^3\times\left(\frac{1\text{ in}}{2.54\text{ cm}}\right)^3\times\frac{1\text{ cm}^3}{1\text{ mL}}\times\frac{1\text{ mL}}{1\times10^{-3}\text{ L}}=\boxed{\mathbf{\$3.06\times10^{-3}\text{ / L}}}$$

b) If it takes 8.61 L of CH_4 to boil a liter of water, starting at room temperature (25°C), how much would it cost to boil a 2.1 L kettle of water?

$$2.1\text{ L water}\times\frac{8.61\text{ L CH}_4}{1\text{ L water}}\times\frac{\$3.06\times10^{-3}}{1\text{ L CH}_4}=\boxed{\mathbf{\$0.055\ =\ 5.5¢}}$$

1.93 **Pheromones are compounds secreted by females of many insect species to attract mates. Typically, 1.0×10^{-8} g of a pheromone is sufficient to reach all targeted males within a radius of 0.50 mi. Calculate the density of the pheromone (in g/L) in a circular air space having a radius of 0.50 mi and a height of 40 ft. [Hint: first calculate the volume of the cylinder described in cm^3.]**

First, let's convert the linear dimensions to cm:

$$r=0.50\text{ mi}\times\frac{1.609\text{ km}}{1\text{ mi}}\times\frac{1\times10^{3}\text{ m}}{1\text{ km}}\times\frac{1\text{ cm}}{1\times10^{-2}\text{ m}}=8.05\times10^{4}\text{ cm (keep 1 extra SF)}$$

$$h=40.\text{ ft}\times\frac{12\text{ in}}{1\text{ ft}}\times\frac{2.54\text{ cm}}{1\text{ in}}=1.22\times10^{3}\text{ cm}$$

volume of cylinder = $\pi r^2 \times h =$ $\pi(8.05 \times 10^4\text{ cm})^2 \times (1.22 \times 10^3\text{ cm}) = 2.48 \times 10^{13}\text{ cm}^3$

$$V=\left(2.48\times10^{13}\text{ cm}^3\right)\times\frac{1\text{ mL}}{1\text{ cm}^3}\times\frac{1\text{ L}}{1000\text{ mL}}=2.48\times10^{10}\text{ L}$$

$$\textbf{density}=\frac{\text{mass}}{\text{volume}}=\frac{1.0\times10^{-8}\text{ g}}{2.48\times10^{10}\text{ L}}=4.032\times10^{-19}=\boxed{\mathbf{4.0\times10^{-19}\text{ g / L}}}$$