

**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  $^{\circ}\text{C} = \text{K} - 273 = 77 \text{ K} - 273 = -196^{\circ}\text{C}$

(b) 4.2 K  $^{\circ}\text{C} = 4.2 \text{ K} - 273 = -269^{\circ}\text{C}$

(c) 601 K  $^{\circ}\text{C} = 601 \text{ K} - 273 = 328^{\circ}\text{C}$

**1.48 Perform the following conversions:**

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

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

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

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

**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<sub>2</sub> is converted into new substances.

- 1.69 The total volume of seawater on earth is  $1.5 \times 10^{21}$  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.

$$1.5 \times 10^{21} \text{ L} \times \frac{1 \text{ mL}}{0.001 \text{ L}} \times \frac{1.03 \text{ g}}{1 \text{ mL}} \times \frac{3.1 \text{ g NaCl}}{100 \text{ g seawater}} \times \frac{1 \text{ kg}}{1 \times 10^3 \text{ g}} = 4.790 \times 10^{19} = \boxed{4.8 \times 10^{19} \text{ kg NaCl}}$$

- 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  $1 \times 10^6$  grams of  $\text{H}_2\text{O}$ ). 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  $2.0 \times 10^4$  gallons of water in the pool.

$$1 \text{ gallon} = 3.79 \text{ L} \quad \text{density of liquids} = 1.0 \text{ g/mL}$$

$$2.0 \times 10^4 \text{ gallons H}_2\text{O} \times \frac{3.79 \text{ L}}{1 \text{ gallon}} \times \frac{1 \text{ mL}}{0.001 \text{ L}} \times \frac{1 \text{ g}}{1 \text{ mL}} = 7.6 \times 10^7 \text{ g H}_2\text{O}$$

$$7.6 \times 10^7 \text{ g H}_2\text{O} \times \frac{1 \text{ g NaOCl}}{1 \times 10^6 \text{ g H}_2\text{O}} = 76 \text{ g NaOCl}$$

Part of solution

$$76 \text{ g NaOCl} \times \frac{100\% \text{ soln}}{6\% \text{ NaOCl}} \times \frac{1 \text{ mL soln}}{1 \text{ g soln}} = \boxed{1.3 \times 10^3 \text{ mL of NaOCl solution (1.3 L)}}$$

100g solution  
6g NaOCl

- 1.92 A gas company charges \$1.30 for 15.0 ft<sup>3</sup> of natural gas.  
(a) Convert this rate to dollars per liter of gas.

$$\frac{\$1.30}{15.0 \text{ ft}^3} \times \left( \frac{1 \text{ ft}}{12 \text{ in}} \right)^3 \times \left( \frac{1 \text{ in}}{2.54 \text{ cm}} \right)^3 \times \frac{1 \text{ cm}^3}{1 \text{ mL}} \times \frac{1 \text{ mL}}{1 \times 10^{-3} \text{ L}} = \boxed{\$3.06 \times 10^{-3} / \text{L}}$$

- b) If it takes 8.61 L of  $\text{CH}_4$  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?

$$2.1 \text{ L water} \times \frac{8.61 \text{ L CH}_4}{1 \text{ L water}} \times \frac{\$3.06 \times 10^{-3}}{1 \text{ L CH}_4} = \boxed{\$0.055 = 5.5\text{¢}}$$

- 1.93 Pheromones are compounds secreted by females of many insect species to attract mates. Typically,  $1.0 \times 10^{-8}$  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<sup>3</sup>.]

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

$$r = 0.50 \text{ mi} \times \frac{1.609 \text{ km}}{1 \text{ mi}} \times \frac{1 \times 10^3 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ cm}}{1 \times 10^{-2} \text{ m}} = 8.05 \times 10^4 \text{ cm (keep 1 extra SF)}$$

$$h = 40. \text{ ft} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{2.54 \text{ cm}}{1 \text{ in}} = 1.22 \times 10^3 \text{ cm}$$

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

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

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