Homework 1 Answer Key

Chapter 1 - 37, 39, 41, 43, 45, 47, 49, 51, 53,
55, 57, 59, 62, 67, 69, 71, 73, 75, 77,
79, 80, 82, 85, 93, 96, 97, 101, 102

49) How many significant figures does each number contain?

a. 16.00 4 sig figs
Trailing Zero's Significant

b. 160 ← no decimal, zero is place holder for value 2 sig figs

c. 0.00160 ← trailing
Place holders
Can write in scientific notation 1.60×10^{-3} = 3 sig figs

d. 1,600,000 = 1.6×10^{6} = 2 sig figs
all place holders

e. 1.06 = 3 sig figs

f. 0.1600 = 1.600×10^{-1} = 4 sig figs
← trailing Zero's

g. 1.060×10^{10} = 4 sig figs
← trailing Zero

h. 1.6×10^{-6} = 2 sig figs

(62) A blood vessel is 0.40 μm in diameter. a) Convert this quantity to meters and write the answer in scientific notation. b) Convert this quantity to inches and write the answer in scientific notation.

a. map $\mu m \longrightarrow m$

equality $1\,\mu m = 1\times10^{-6}\,m$

$$\overset{2}{0.40}\,\cancel{\mu m} \times \frac{\overset{\text{exact}}{1\times10^{-6}\,m}}{1\,\cancel{\mu m}} = \boxed{4.0\times10^{-7}\,m}$$

b. map $\mu m \longrightarrow m \longrightarrow cm \longrightarrow in$

equalities
$1\,\mu m = 1\times10^{-6}\,m$ exact
$1\,cm = 1\times10^{-2}\,m$ exact
$1\,in = 2.54\,cm$ exact

$$\overset{2}{0.40}\,\cancel{\mu m} \times \frac{\overset{\text{exact}}{1\times10^{-6}\,\cancel{m}}}{1\,\cancel{\mu m}} \times \frac{1\,\cancel{cm}}{\underset{\text{exact}}{1\times10^{-2}\,\cancel{m}}} \times \frac{1\,in}{\underset{\text{exact}}{2.54\,\cancel{cm}}} =$$

$$= 1.57480315\times10^{-5}\,in$$

$$= \boxed{1.6\times10^{-5}\,in}$$

67) Carry out each of the following conversions.

a. 300g to mg

$g \longrightarrow mg$ map

$1\,mg = 1\times10^{-3}\,g$ equality

$$\overset{\text{1sf}}{300\,g} \times \frac{1\,mg}{\underset{\text{Exact}}{1\times10^{-3}\,g}} = 300{,}000\,mg = \underset{\text{1sf}}{\boxed{3\times10^{5}\,mg}}$$

b. 2 L to μL

$L \longrightarrow \mu L$ map

$1\,\mu L = 1\times10^{-6}\,L$ equality

$$\underset{\text{1sf}}{2\,L} \times \frac{1\,\mu L}{\underset{\text{exact}}{1\times10^{-6}\,L}} = 2{,}000{,}000\,\mu L = \underset{\text{1sf}}{\boxed{2\times10^{6}\,\mu L}}$$

c. 5.0 cm to m

$cm \longrightarrow m$

$1\,cm = 1\times10^{-2}\,m$

$$\underset{\text{2sf}}{5.0\,cm} \times \frac{1\times10^{-2}\,m}{\underset{\text{exact}}{1\,cm}} = 0.050\,m = \underset{\text{2sf}}{\boxed{5.0\times10^{-2}\,m}}$$

d. 300g to oz

$g \longrightarrow lb \longrightarrow oz$

$1\,lb = 453.6\,g$

$1\,lb = 16\,oz$

$$\underset{\text{1sf}}{300\,\cancel{g}} \times \frac{1\,\cancel{lb}}{\underset{\text{4sf}}{453.6\,\cancel{g}}} \times \frac{16\,oz}{\underset{\text{exact}}{1\,\cancel{lb}}} = 10.58201058\,oz$$

$$= 10\,oz = \underset{\text{1sf}}{\boxed{1\times10^{1}\,oz}}$$

67) Carry out each of the following conversions.

e. 2 ft to m

ft → in → cm → m   map

$$\left.\begin{aligned} 12\text{ in} &= 1\text{ ft} \\ 2.54\text{ cm} &= 1\text{ in} \\ 100\text{ cm} &= 1\text{ m} \end{aligned}\right\}\text{ equalities}$$

$$\underset{1\text{ sf}}{2\cancel{\text{ft}}} \times \frac{12\cancel{\text{in}}}{\underset{\text{exact}}{1\cancel{\text{ft}}}} \times \frac{\overset{\text{exact}}{2.54\cancel{\text{cm}}}}{1\cancel{\text{in}}} \times \frac{1\text{ m}}{\underset{\text{exact}}{100\cancel{\text{cm}}}} = \underset{1\text{sf}}{0.6|096\text{ m}}$$

$$= \boxed{0.6\text{ m}}$$

f. 3.5 yd to m

yd → ft → in → cm → m

3 ft = 1 yard

1 ft = 12 inches

2.54 cm = 1 inch

100 cm = 1 m

$$\underset{2\text{ sf}}{3.5\text{ yd}} \times \frac{\overset{\text{exact}}{3\text{ ft}}}{1\text{ yd}} \times \frac{\overset{\text{exact}}{12\text{ in}}}{1\text{ ft}} \times \frac{\overset{\text{exact}}{2.54\text{ cm}}}{1\text{ in}} \times \frac{\overset{\text{exact}}{1\text{ m}}}{100\text{ cm}} =$$

$$= 3.2|004\text{ m} \quad 2\text{ sf}$$

$$= \boxed{3.2\text{ m}}$$

73) Carry out each of the following temperature conversions.

a. An over-the-counter pain reliever melts at 53°C. Convert this temperature to °F & K.

$$^\circ C \times \frac{180^\circ F}{100^\circ C} + 32^\circ F$$

$$53^\circ C \times \frac{180^\circ F}{100^\circ C} + 32^\circ F = 127.4^\circ F$$

Sig figs ⟹ Do in steps ⟹ mult. first

$$\underset{2\,sf}{53^\circ C} \times \underset{exact}{\frac{180^\circ F}{100^\circ C}} = 9\underline{5}.4$$

add. Second

$$\begin{array}{r} 9\underline{5}.4 \\ +\ 32 \\ \hline 12\underline{7}.4 \end{array}$$

⇐ good to 1's place

⇐ exact w/ infinite zero's

$$= \boxed{127^\circ F}$$

$$^\circ C + 273.15 = K$$

$$\begin{array}{r} 53 \\ +\ 273.15 \\ \hline 32\underline{6}.15 \end{array} = \boxed{326\ K}$$

b. A cake is baked at 350. °F. Convert this temperature to °C & K

$$(^\circ F - 32) \times \frac{100^\circ C}{180^\circ F}$$

subtraction first

$$\begin{array}{r} 350. \\ -\ 32 \\ \hline 31\underline{8} \end{array}$$

⇐ good to 1's place

⇐ exact

$$318^\circ \cancel{F} \times \frac{100^\circ C}{180^\circ \cancel{F}} = 17\underline{6}.66667^\circ C$$

$$= \boxed{177^\circ C}$$

73) b. A cake is baked at 350.°F. Convert this temperature to K.

Use the unrounded °C value from the last answer. 176.66667 °C

°C + 273.15 = K

uncertainty resides here

$$\begin{array}{r} 176.66667 \\ +\ 273.15 \\ \hline 449.81667 \text{ K} \end{array}$$

$= \boxed{450.\text{ K} \quad \text{or} \quad 4.50 \times 10^2 \text{ K}}$ 3 sig figs

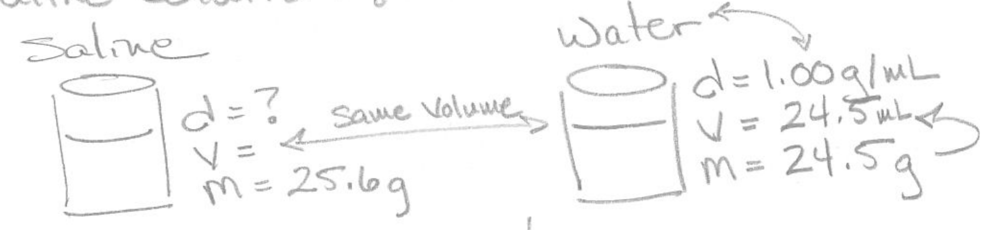
79) If a urine sample has a mass of 122g and a volume of 121 mL, what is its density in g/mL?

$D = \frac{\text{Mass}}{\text{Volume}}$

$\frac{122 g}{121 mL} = 1.008264463 \text{ g/mL}$

$= \boxed{1.01 \text{ g/mL}}$

80) A volume of saline solution had a mass of 25.6g at 4°C. An equal volume of water at the same temperature had a mass of 24.5g. What is the density of the saline solution?



$d_{saline} = \frac{25.6 g}{24.5 mL} = 1.044897959 \text{ g/mL}$

$= \boxed{1.04 \text{ g/mL}}$

82) If gasoline has a density of 0.66g/mL, what is the mass of one gallone reported in kg?

* poorly written ⇒ use "one gallon" as exact value.

<u>Map</u>

$$\underset{\text{eng} \to \text{SI}}{\boxed{gal \rightarrow L}} \rightarrow \underset{\text{mass} \to \text{volume}}{\boxed{mL \rightarrow g}} \rightarrow kg$$

<u>equalities</u>

$1\,gal = 3.785\,L$

$1\,L = 1000\,mL$

$0.66\,g = 1\,mL$ ⟸ Density

$1\,kg = 1000\,g$

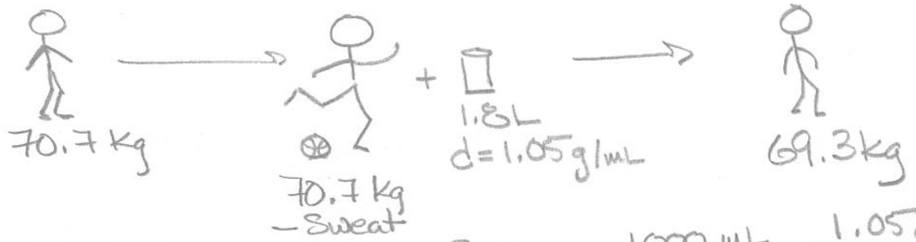
<u>Equation</u>

$$\overset{\text{exact}}{1\,gal} \times \overset{\text{4sf}}{\frac{3.785\,L}{1\,gal}} \times \overset{\text{exact}}{\frac{1000\,mL}{1\,L}} \times \overset{\text{2 sig fig}}{\frac{0.66g}{1\,mL}} \times \overset{\text{exact}}{\frac{1\,kg}{1000g}} =$$

$$= 2.4|981\,kg$$

$$= \boxed{2.5\,kg}$$

88) A soccer play weighed 70.7 kg before a match, drank 1.8L of liquid (d = 1.05g/mL) during the match, and weighed 69.3kg after the match. How many pounds of Sweat did the player lose?



$$70.7\,kg - \underline{\underline{Sweat}} + \left[1.8L \times \frac{1000\,mL}{1\,L} \times \frac{1.05g}{1\,mL}\right] = 69.3\,kg$$

Continued on next page

88)

$$70.7\,\text{kg} - \text{Sweat} + \left[1.8\,\text{L} \times \frac{1000\,\text{mL}}{1\,\text{L}} \times \frac{1.05\,\text{g}}{1\,\text{mL}}\right] = 69.3\,\text{kg}$$

Forgot earlier

Solve for Sweat

$$\text{Sweat} = 70.7\,\text{kg} - 69.3\,\text{kg} + \left[\overset{\text{2SF}}{1.8\,\text{L}} \times \overset{\text{exact}}{\frac{1000\,\text{mL}}{1\,\text{L}}} \times \overset{\text{3SF}}{\frac{1.05\,\text{g}}{1\,\text{mL}}} \times \underset{\text{exact}}{\frac{1\,\text{kg}}{1000\,\text{g}}}\right]$$

good to 2SF, but let run long until done

$$= 70.7\,\text{kg} - 69.3\,\text{kg} + 1.\underline{8}9\,\text{kg}$$

$$= 3.29\,\text{kg} \quad \text{sig figs?}$$

$$\begin{array}{r|l} 70.7 & \text{kg} \\ -\ 69.3 & \text{kg} \\ \hline 1.\underline{4} & \text{kg} \\ +\ 1.\underline{8} & 9\,\text{kg} \\ \hline 3.\underline{2} & 9\,\text{kg} \end{array} \Longrightarrow \boxed{3.3\,\text{kg}}$$

Key was to evaluate the mass of liquid he drank first. Evaluate sig figs, but don't truncate until add/sub step. Watch the add/sub sig fig rules!

96) A patient receives an intravenous (IV) solution that flows at the rate of $\boxed{150\text{ mL per hour.}}$ a) How much fluid does the patient receive in 20. min? b) How long does it take for the patient to receive 90. mL of fluid? c) If the IV bag holds 600. mL of fluid, how many minutes does it take to empty the bag? d) If the solution contains 90. mg glucose per mL, how long will it take to give the patient 2.0 g glucose?

Key ⟹ Rate = 150. mL per hour

⟹ Think equality $\boxed{150.\text{ mL} = 1\text{ hr}}$

a. mL in 20. min?

$$\text{min} \longrightarrow \text{hr} \longrightarrow \text{mL}$$

$$\overset{2}{20.}\,\cancel{\text{min}} \times \frac{1\,\cancel{\text{hr}}}{\underset{\text{exact}}{60\,\cancel{\text{min}}}} \times \frac{\overset{3}{150.}\,\text{mL}}{1\,\cancel{\text{hr}}} = \boxed{\overset{2}{50.}\text{ mL or } 5.0\times10^{1}\text{ mL}}$$

b. How long 90. mL?

$$\text{mL} \longrightarrow \text{hr}$$

$$\overset{2}{90.}\text{ mL} \times \frac{1\text{ hr}}{\underset{3}{150.}\text{ mL}} = \underset{\text{need 2 sf}}{0.6\text{ hr}} = \boxed{0.60\text{ hr}}$$

c. Mins for 600. mL

$$\text{mL} \longrightarrow \text{hr} \longrightarrow \text{min}$$

$$\overset{3}{600.}\text{ mL} \times \frac{1\text{ hr}}{\underset{3}{150.}\text{ mL}} \times \frac{\overset{\text{exact}}{60\text{ min}}}{1\text{ hr}} = \boxed{240.\text{ min}}$$

d. 2.0 g glucose = ? hr

$$\text{g glucose} \longrightarrow \text{mg glucose} \longrightarrow \text{mL Solution} \longrightarrow \text{hr}$$

$$\overset{2}{2.0}\,\cancel{\text{g glucose}} \times \frac{\overset{\text{exact}}{1000\,\cancel{\text{mg glucose}}}}{1\,\cancel{\text{g glucose}}} \times \frac{1\,\cancel{\text{mL Solution}}}{\underset{2}{90.}\,\cancel{\text{mg glucose}}} \times \frac{1\text{ hr}}{\underset{3}{150.}\,\cancel{\text{mL Solution}}} = 0.148148\text{ hr} = \boxed{0.15\text{ hr}}$$

102) Artemether, an antimalarial drug prepared from the Chinese antimalarial plant Artemisia annua, can be given either orally or by injection. When the drug is given in pill form, the patient receives 160 mg on the first day, and then 80. mg daily for the next four days. When the drug is given by injection, the patient receives 3.2 mg/kg of body weight on the first day, and then 1.6 mg/kg daily for the next four days. a) Which method gives a 40. kg individual the larger dose? b) Which method gives a 100. kg individual the larger dose?

Pill = 160 mg + 4 · 80. mg = 480 mg total dose
⇒ not dependent on body weight

Injection = 3.2 mg/kg + 4 · 1.6 mg/kg = 9.6 mg/kg total dose

⇒ Don't let the mg/kg throw you, you can still calc. the total dose, just in mg/kg of body weight. :)

Now compare

a) 40. kg

$\boxed{\text{Pill} = 480 \text{ mg}}$ Larger!

$\text{Injection} = 40.\text{ kg} \times \frac{9.6 \text{ mg}}{1 \text{ kg}} = 38|4 \text{ mg} = 380 \text{ mg}$

b) 100. kg

Pill = 480 mg

$\boxed{\text{Injection} = 100.\text{ kg} \times \frac{9.6 \text{ mg}}{1 \text{ kg}} = 960 \text{ mg}}$ Larger!