NAME Key

Su2019/ CHEM1301/ Homework 3

Due: 7/11/2019

1. Use dimensional analysis to complete the following SIMPLE unit conversions.

a) Convert 84.100 yards (yds) to inches

$$84.100\,\text{yds}\left(\frac{3\,\text{ft}}{1\,\text{yd}}\right)\left(\frac{36\,\text{in}}{3\,\text{ft}}\right) = 9.0828\times10^{3}\,\text{in}$$

b) Convert 84.100 inches to yards

$$84.100\,\text{inches}\left(\frac{1\,\text{ft}}{12\,\text{in}}\right)\left(\frac{1\,\text{yd}}{3\,\text{ft}}\right) = 2.3361\,\text{yd}$$

c) Convert 3.706 days to seconds

$$3.706\,\text{days}\left(\frac{24\,\text{hr}}{1\,\text{day}}\right)\left(\frac{60\,\text{min}}{1\,\text{hr}}\right)\left(\frac{60\,\text{s}}{1\,\text{min}}\right) = 3.202\times10^{5}\,\text{s}$$

d) 12.004 gallons to fl oz

$$12.004\,\text{gal}\left(\frac{128\,\text{fl oz}}{1\,\text{gal}}\right) = 1536.5\,\text{fl oz}$$

e) 14.600 pounds to oz

$$14.600\,\text{lbs}\left(\frac{16\,\text{oz}}{1\,\text{lb}}\right) = 233.60\,\text{oz}$$

f) 87.304 Liters (L) to cups

$$87.304\,\text{L}\left(\frac{1.057\,\text{qt}}{1\,\text{L}}\right)\left(\frac{8\,\text{pt}}{4\,\text{qt}}\right)\left(\frac{2\,\text{cups}}{1\,\text{pt}}\right) = 369.12\,\text{cups}$$

g) 1.203×10^{8} miles to cm

$$1.203\times10^{8}\,\text{mi}\left(\frac{5280\,\text{ft}}{1\,\text{mi}}\right)\left(\frac{12\,\text{in}}{1\,\text{ft}}\right)\left(\frac{2.54\,\text{cm}}{1\,\text{in}}\right) = 1.936\times10^{13}$$

h) 4.500 minutes to weeks

$$4.500\,\text{min}\left(\frac{1\,\text{hr}}{60\,\text{min}}\right)\left(\frac{1\,\text{day}}{24\,\text{hr}}\right)\left(\frac{1\,\text{week}}{7\,\text{day}}\right) = 4.464\times10^{-4}\,\text{weeks}$$

2. Write the conversion factor from prefix multipliers needed for the following metric conversions.

	Conversion Factor:
Example: pm to m	$1\text{pm} = 10^{-12}\text{ m}$
a) kg to g	$1\text{ kg} = 10^{3}\text{ g}$
b) g to µg (micro)	$1\ \mu\text{g} = 10^{-6}\text{ g}$
c) ML to L	$1\text{ ML} = 10^{6}\text{ L}$
d) m to cm	$1\text{ cm} = 10^{-2}\text{ m}$
e) ns to s	$1\text{ ns} = 10^{-9}\text{ s}$

3. Using prefix multipliers, perform the following metric conversions. Show all work to receive credit, and mind your sig figs!

a) Convert 1.65 L to mL.

$$1.65\text{ L}\left(\frac{1\text{ mL}}{10^{-3}\text{ L}}\right) = \boxed{1.65\times10^{3}\text{ mL}}$$

b) Convert 4.32×10^{6} mL to L

$$4.32\times10^{6}\text{ mL}\left(\frac{10^{-3}\text{ L}}{1\text{ mL}}\right) = \boxed{4.32\times10^{3}\text{ L}}$$

c) Convert 789.35 nm to m

$$789.35\text{ nm}\left(\frac{10^{-9}\text{ m}}{1\text{ nm}}\right) = \boxed{7.8935\times10^{-7}\text{ m}}$$

d) Convert 6.48×10^{-8} kg to g

$$6.48\times10^{-8}\text{ kg}\left(\frac{10^{3}\text{ g}}{1\text{ kg}}\right) = \boxed{6.48\times10^{-5}\text{ g}}$$

e) Convert 4.653×10^{10} s to Ms

$$4.653\times10^{10}\text{ s}\left(\frac{1\text{ Ms}}{10^{6}\text{ s}}\right) = \boxed{4.653\times10^{4}\text{ Ms}}$$

4. Using prefix multipliers, perform the following metric conversions. Show all work to receive credit, and mind your sig figs!

a) Convert 1.42 kg to mg

$$1.42\,kg\left(\frac{10^{3}\,g}{1\,kg}\right)\left(\frac{1\,mg}{10^{-3}\,g}\right)=\boxed{1.42\times10^{6}\,mg}$$

b) Convert 131 μs to ms

$$131\,\mu s\left(\frac{10^{-6}\,s}{1\,\mu s}\right)\left(\frac{1\,ms}{10^{-3}\,s}\right)=\boxed{.131\,ms}$$

c) Convert 1.26×10^{4} Tm to Mm

$$1.26\times10^{4}\,Tm\left(\frac{10^{12}\,m}{1\,Tm}\right)\left(\frac{1\,Mm}{10^{6}\,m}\right)=\boxed{1.26\times10^{10}\,Mm}$$

d) Convert 12.7 nK to μK

$$12.7\,nK\left(\frac{10^{-9}\,K}{1\,nK}\right)\left(\frac{1\,\mu K}{10^{-6}\,K}\right)=1.27\times10^{-2}\,\mu K$$

e) Convert 4.268×10^{-5} km to mm

$$4.268\times10^{-5}\,km\left(\frac{10^{3}\,m}{1\,km}\right)\left(\frac{1\,mm}{10^{-3}\,m}\right)=42.68\,mm$$

5. Shake it up: Use both conventional conversion factors and metric prefix multipliers to complete the following.

a) convert 14.65 cups to mL

$$14.65\,cups\left(\frac{1\,qt}{16\,cups}\right)\left(\frac{1\,L}{1.057\,qt}\right)\left(\frac{1\,mL}{10^{-3}\,L}\right)=\boxed{866.2\,mL}$$

b) convert 2.34×10^{23} ns to days

$$2.34\times10^{23}\,ns\left(\frac{10^{-9}\,s}{1\,ns}\right)\left(\frac{1\,min}{60\,s}\right)\left(\frac{1\,hr}{60\,min}\right)\left(\frac{1\,day}{24\,hrs}\right)=\boxed{2.71\times10^{9}\,days}$$

6. Complete the table below with conversion factors for the following volume and area conversions.

	Conversion Factor:
Example: pm^2 to m^2	1pm = 10^{-12} m so, square numbers and units to give: **$1pm^2 = 10^{-24}\ m^2$**
a) km^3 to m^3	$1\,km = 10^3\,m \Rightarrow 1\,km^3 = 10^9\,m^3$
b) m^2 to μm^2 (micro)	$1\,\mu m = 10^{-6}\,m \Rightarrow 1\,\mu m^2 = 10^{-12}\,m^2$
c) cm^3 to m^3	$1\,cm = 10^{-2}\,m \Rightarrow 1\,cm^3 = 10^{-6}\,m^3$
d) in^2 to ft^2	$12\,in = 1\,ft \Rightarrow 144\,in^2 = 1\,ft^2$
e) ft^3 to mi^3	$1\,mi = 5280\,ft \Rightarrow 1\,mi^3 = 1.472\times10^{11}\,ft^3$

7. Convert the following quantities with units of area and volume.

Convert 14.23 cm^2 to in^2

$$14.23\,cm^2\left(\frac{1\,in^2}{6.4516\,cm^2}\right) = \boxed{2.206\,in^2}$$

Convert 1.65×10^{12} cm^3 to m^3

$$1.65\times10^{12}\,cm^3\left(\frac{10^{-6}\,m^3}{1\,cm^3}\right) = \boxed{1.65\times10^{6}\,m^3}$$

Convert $5.32 \times 10^{-6} km^2$ to mm^2

$1\,mm = 10^{-3}\,m$

$$5.32\times10^{-6}\,km^2\left(\frac{10^{6}\,m^2}{1\,km^2}\right)\left(\frac{1\,mm^2}{10^{-6}\,m^2}\right) = \boxed{5.32\times10^{6}\,mm^2}$$

$1\,km = 10^3\,m$

8. Calculate the density of a sample that has a mass of 35.62 g and a volume of 4.35 cm^3.

$$D = \frac{35.62\,g}{4.35\,cm^3} = \boxed{8.19\,g/cm^3}$$

9. Glycerol is a liquid found in some cosmetics. A 1.50 L bottle of glycerol has a mass of 1.75×10^3 g. What is the density of glycerol in kg per m^3? (kg/m^3)

$$1.75 \times 10^3\,g \left(\frac{1\,kg}{10^3\,g}\right) = 1.75\,kg$$

$$1.50\,L \left(\frac{1000\,cm^3}{1\,L}\right)\left(\frac{10^{-6}\,m^3}{1\,cm^3}\right) = .0015\,m^3$$

$1\,cm = 10^{-2}\,m$

$$D = \frac{1.75\,kg}{.0015\,m^3} = \boxed{1.17 \times 10^3\,\frac{kg}{m^3}}$$

10. A ring made of pure gold has a density of 19.32 g/cm^3. The mass of a ring made of pure gold is 12.654g. What volume in (cm^3) does the ring displace?

$$12.654\,g \left(\frac{1\,cm^3}{19.32\,g}\right) = \boxed{.6552\,cm^3}$$

11. Another sample of gold has a volume of 21.05 in^3. Using the density above, what is the mass in pounds of this sample?

$$21.05\,in^3 \left(\frac{16.3871\,cm^3}{1\,in^3}\right)\left(\frac{19.32\,g}{1\,cm^3}\right)\left(\frac{1\,lb}{453.6\,g}\right) = \boxed{14.69\,lbs}$$

12. An average molecule in the room is moving at 500 m/s. What is that speed in miles per hour?

yikes! sorry about the SF!

$$\frac{500\,m}{s}\left(\frac{1\,km}{10^3\,m}\right)\left(\frac{1\,mi}{1.609\,km}\right)\left(\frac{60\,s}{1\,min}\right)\left(\frac{60\,min}{1\,hr}\right) =$$

$$\boxed{1118.71\,mi/hr}$$

Won't look at SF for grading!