Chapter 2 Review
CHEM 1301

Basic Skills:

- ☐ **Go back and forth between writing a number in long form and scientific notation**
  - Convert the decimal numbers below into scientific notation:

1. 2,365.005	2.365005×10^{3}	6. 7,680,000	7.68×10^{6}
2. 0.0000647	6.47×10^{-5}	7. 7,400.1	7.4001×10^{3}
3. 265,000,000.0	2.65×10^{8}	8. 0.00000000098	9.8×10^{-10}
4. 23.1	2.31×10^{1}	9. 0.15	1.5×10^{-1}
5. .00985	9.85×10^{-3}	10. 698,563	6.98563×10^{5}

  - Convert the numbers below from scientific notation back to decimal form:

1. 5.786×10^{3}	5,786	6. 7.43×10^{-2}	0.0743
2. 2.09×10^{6}	2090000	7. 1.23×10^{1}	12.3
3. 7.809×10^{-8}	0.00000007809	8. 3.45×10^{-4}	0.000 345
4. 1.99×10^{2}	199	9. 6.02×10^{23}	602000000000000000000000
5. 2.34×10^{-10}	0.000 000 000 234	10. 3.0×10^{8}	300,000,000

602 and 21 zeros

- ☐ **Multiply/Divide powers of 10 (without a calculator)**
  - Solve the following expressions (leave answer as 10^{n})

1. $\frac{10^{34}}{10^{12}}$	$10^{34-12} = 10^{22}$
2. $10^{5} \times 10^{-9} \times 10^{6}$	$10^{(5-9+6)} = 10^{2}$
3. $\frac{10^{23} \times 10^{8}}{10^{5}}$	$10^{(23+8-5)} = 10^{26}$
4. $(10^{6})^{2}$	$10^{6 \cdot 2} = 10^{12}$
5. $10^{12} \times 10^{-2} \times (10^{9})^{-2}$	$10^{(12+-2+(9 \times -2))} = 10^{-8}$

I underlined the Significant ones in RED!

☐ **Count the number of sig figs in a reported number**

- How many sig figs do the following numbers have?

1. 0.0000543	3	6. 7.043×10^{-2}	4
2. 23000856	8	7. 24 atoms	∞ (exact #)
3. 29000	2	8. 2.900	4
4. 0.002300	4	9. 290050	5
5. 0.00500200	6	10. 900.02	5

this 0 is NOT Sig.

☐ **Estimate a number to a given number of sig figs**

- Round each of the following to 4 sig figs (some you will have to write in Scientific Notation):

1. 0.00023097	0.0002310 or 2.310×10^{-4}	6. 7.0098×10^{-2}	7.010×10^{-2}, 0.07010
2. 230856	230900 or 2.309×10^{5}	7. 590.09	590.1 or 5.901×10^{2}
3. 29000	2.900×10^{4}	8. 2.900670	2.901
4. 0.1002300	0.1002 or 1.002×10^{-1}	9. 290000	2.900×10^{5}
5. 0.00500200	0.005002 or 5.002×10^{-3}	10. 9000.02	9.000×10^{3}

☐ **Do math with correct sig figs**

- Evaluate the following:

1. 203.659 + 23.0569 − 145.08 =	81.6359 = 81.64
2. 0.0023 * 60.05 =	0.138115 = 0.14
3. (236.098 − 234.0267) × 100.5 = (2.0713)	208.166 = 208.2
4. 52.06 ÷ 23 + 55.68 = (2.26348)	57.9435 = 57.9
5. 29.06 ÷ 45.98 =	0.632014 = 0.6320

Multistep Conversions:

1. Convert 14 centuries to days:
   1 century = 100 years
   1 year = 365 days
   $14 \text{ centuries} \left(\frac{100 \text{ years}}{1 \text{ century}}\right)\left(\frac{365 \text{ days}}{1 \text{ yr}}\right) =$

2. Convert 9 wk to hr:
   1 week = 7 days
   1 day = 24 hr
   $9 \text{ wk} \left(\frac{7 \text{ days}}{1 \text{ wk}}\right)\left(\frac{24 \text{ hr}}{1 \text{ day}}\right) =$

3. Convert 14 gal to cups:
   1 gal = 4 qt
   1 qt = 2 pints
   1 pt = 2 cups
   $14 \text{ gal} \left(\frac{4 \text{ qt}}{1 \text{ gal}}\right)\left(\frac{2 \text{ pts}}{1 \text{ qt}}\right)\left(\frac{2 \text{ cups}}{1 \text{ pt}}\right) =$

4. Convert 6 cm to ft:
   1 in = 2.54 cm
   12 in = 1 ft
   $6 \text{ cm} \left(\frac{1 \text{ in}}{2.54 \text{ cm}}\right)\left(\frac{1 \text{ ft}}{12 \text{ in}}\right) =$

5. Convert 15 pt to fl oz:
   1 pt = 2 cups
   1 cup = 8 fl oz
   $15 \text{ pt} \left(\frac{2 \text{ cups}}{1 \text{ pt}}\right)\left(\frac{8 \text{ fl oz}}{1 \text{ cup}}\right) =$

6. Convert 5 m to in:
   1 m = 39.37 in
   $5 \text{ m} \left(\frac{39.37 \text{ in}}{1 \text{ m}}\right) =$

7. Convert 10 km to ft:
   1.609 km = 1 mile
   1 mile = 5280 ft
   $10 \text{ km} \left(\frac{1 \text{ mi}}{1.609 \text{ km}}\right)\left(\frac{5280 \text{ ft}}{1 \text{ mi}}\right)$

8. Convert 3 wk to min:
   1 wk = 7 day
   1 day = 24 hr
   1 hr = 60 min
   $3 \text{ wk} \left(\frac{7 \text{ days}}{1 \text{ wk}}\right)\left(\frac{24 \text{ hr}}{1 \text{ day}}\right)\left(\frac{60 \text{ min}}{1 \text{ hr}}\right)$

9. Convert 9 km to in:
   1.609 km = 1 mile = 5280 ft
   1 ft = 12 in
   $9 \text{ km} \left(\frac{5280 \text{ ft}}{1.609 \text{ km}}\right)\left(\frac{12 \text{ in}}{1 \text{ ft}}\right) =$

10. Convert 6 gal to pt:
    1 gal = 8 pt
    $6 \text{ gal} \left(\frac{8 \text{ pt}}{1 \text{ gal}}\right) =$

Metric Prefix Conversions:

1. 4.3×10^{34} nm = _____ m

$1\text{ nm} = 10^{-9}\text{ m}$

$4.3\times10^{34}\text{ nm}\left(\frac{10^{-9}\text{ m}}{1\text{ nm}}\right) = 4.3\times10^{25}\text{ m}$

2. 8.5×10^{8} kg = _____ g

$1\text{ kg} = 10^{3}\text{ g}$

$8.5\times10^{8}\text{ kg}\left(\frac{10^{3}\text{ g}}{1\text{ kg}}\right) = 8.5\times10^{11}\text{ g}$

3. 100.0 cm = _____ µm

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

$1\text{ µm} = 10^{-6}\text{ m}$

$100.0\text{ cm}\left(\frac{10^{-2}\text{ m}}{1\text{ cm}}\right)\left(\frac{1\text{ µm}}{10^{-6}\text{ m}}\right) = 10^{2-2--6}$

$= 10^{6}\text{ µm}$

4. 238.02 ps = _____ ns

$1\text{ ps} = 10^{-12}\text{ s}$

$1\text{ ns} = 10^{-9}\text{ s}$

$238.02\text{ ps}\left(\frac{10^{-12}\text{ s}}{1\text{ ps}}\right)\left(\frac{1\text{ ns}}{10^{-9}\text{ s}}\right) = 0.23802\text{ ns}$

5. 685.3 Mg = _____ kg

$1\text{ Mg} = 10^{6}\text{ g}$

$1\text{ kg} = 10^{3}\text{ g}$

$685.3\text{ Mg}\left(\frac{10^{6}\text{ g}}{1\text{ Mg}}\right)\left(\frac{1\text{ kg}}{10^{3}\text{ g}}\right) = 6.853\times10^{5}\text{ kg}$

6. 3.0×10^{14} mL = _____ dL

$1\text{ mL} = 10^{-3}\text{ L}$

$1\text{ dL} = 10^{-2}\text{ L}$

$3.0\times10^{14}\text{ mL}\left(\frac{10^{-3}\text{ L}}{1\text{ mL}}\right)\left(\frac{1\text{ dL}}{10^{-2}\text{ L}}\right) = 3.0\times10^{13}\text{ dL}$

Conversions:

☐ **Convert between metric prefixes (without Table 2.2)**

1. 2.4×10^{12} nm = _____ m

nm → m

CF: $1\text{nm} = 10^{-9}\text{m}$

$2.4\times10^{12}\,\text{nm}\left(\frac{10^{-9}\text{m}}{1\,\text{nm}}\right) = 2.4\times10^{3}\,\text{m}$

2. 2.4×10^{-3} kg = _____ g

kg → g

CF: $1\text{kg} = 10^{3}\text{g}$

$2.4\times10^{-3}\,\text{kg}\left(\frac{10^{3}\text{g}}{1\,\text{kg}}\right) = 2.4\text{g}$

3. 2.4×10^{-12}s = _____ μs

s → μs

$1\,\mu\text{s} = 10^{-6}\text{s}$

$2.4\times10^{-12}\,\text{s}\left(\frac{1\,\mu\text{s}}{10^{-6}\,\text{s}}\right) = 2.4\times10^{-6}\,\mu\text{s}$

4. 2400000 ps = _____ ns

ps → s → ns

CF: $1\text{ps} = 10^{-12}\text{s}$

$1\text{ns} = 10^{-9}\text{s}$

$2400000\text{ps} = 2.4\times10^{6}\text{ps}$

$2.4\times10^{6}\,\text{ps}\left(\frac{10^{-12}\,\text{s}}{1\,\text{ps}}\right)\left(\frac{1\,\text{ns}}{10^{-9}\,\text{s}}\right) = 2.4\times10^{3}\,\text{ns}$

5. 0.000000024Mmol = _____ kmol

Mmol → mol → kmol

CF: $1\text{Mmol} = 10^{6}\text{mol}$

$1\text{kmol} = 10^{3}\text{mol}$

$0.000\,000\,024\,\text{Mmol} = 2.4\times10^{-8}\,\text{Mmol}$

$2.4\times10^{-8}\,\text{Mmol}\left(\frac{10^{6}\,\text{mol}}{1\,\text{Mmol}}\right)\left(\frac{1\,\text{kmol}}{10^{3}\,\text{mol}}\right) =$

$2.4\times10^{1}\,\text{kmol}$

or 24 kmol

☐ **Convert volume or area units (units raised to a power)**

1. 34.6 cm^3 = _____ m^3

$cm^3 \rightarrow m^3$

CF: $(1\,cm)^3 = (10^{-2}\,m)^3$ → CF: $1\,cm^3 = 10^{-6}\,m^3$

$34.6\,cm^3 \left(\frac{10^{-6}\,m^3}{1\,cm^3}\right) = \boxed{3.46\times10^{-5}\,m^3}$

2. 983.5 mm^2 = _____ cm^2

$mm^2 \rightarrow m^2 \rightarrow cm^2$

CF: $(1\,mm)^2 = (10^{-3}\,m)^2 \Rightarrow 1\,mm^2 = 10^{-6}\,m^2$

$(1\,cm)^2 = (10^{-2}\,m)^2 \Rightarrow 1\,cm^2 = 10^{-4}\,m^2$

$983.5\,mm^2 \left(\frac{10^{-6}\,m^2}{1\,mm^2}\right)\left(\frac{1\,cm^2}{10^{-4}\,m^2}\right)$

$= 983.5\times10^{(-6+4)}\,cm^2$

$= \boxed{9.835\,cm^2}$

3. 13.2 L = _____ dm^3 (don't forget: $1cm^3 = 1mL$)

$L \rightarrow mL \rightarrow cm^3 \rightarrow m^3 \rightarrow dm^3$

CF: $1\,mL = 10^{-3}\,L$

$1\,cm^3 = 1\,mL$

$1\,cm^3 = 10^{-6}\,m^3$

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

$13.2\,L \left(\frac{1\,mL}{10^{-3}\,L}\right)\left(\frac{1\,cm^3}{1\,mL}\right)\left(\frac{10^{-6}\,m^3}{1\,cm^3}\right)\left(\frac{1\,dm^3}{10^{-3}\,m^3}\right)$

$= 13.2\times10^{\underbrace{(-6+3+3)}_{=0}} = \boxed{13.2\,dm^3}$

☐ **Convert from one unit to another (English ↔ Metric) in single and multi-step conversions**

1. 10.43 in = _____ ft

$in \rightarrow ft$

CF: $12\,in = 1\,ft$

$10.43\,in \left(\frac{1\,ft}{12\,in}\right) = .869167\,ft$

$= \boxed{0.8692\,ft}$

2. 65.32 gal = _____ L

$gal \rightarrow L$

CF: $1\,gal = 3.785\,L$

$65.32\,gal \left(\frac{3.785\,L}{1\,gal}\right) = 247.2356\,L$

$= \boxed{247.2\,L}$

3. 1.000 miles = _____ cm

$miles \rightarrow km \rightarrow m \rightarrow cm$

CF: $1\,mile = 1.609\,km$

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

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

$1.000\,miles \left(\frac{1.609\,km}{1\,mile}\right)\left(\frac{10^3\,m}{1\,km}\right)\left(\frac{1\,cm}{10^{-2}\,m}\right)$

$= 1.609\times10^{3+2}\,cm = \boxed{1.609\times10^5\,cm}$

☐ **Calculate density**

1. A piece of metal has a volume of 45.01 cm^3 and a mass of 429.789 g. Calculate the density.

$D = \frac{m}{V}$ $m = 429.789g$ $V = 45.01 cm^3$

$D = \frac{429.789g}{45.01 cm^3} = 9.54894\ g/cm^3 = \boxed{9.549\ g/cm^3}$

2. A 1.5 L sample of a liquid has a mass of 2.98×10^3g. What is the density of the liquid in g/L and g/cm^3?

Given: $m = 2.98 \times 10^3 g$ $V = 1.5L$

① Calculate D in g/L

$D = \frac{m}{V} = \frac{2.98 \times 10^3 g}{1.5L}$

$= 1.98667 \times 10^3 \frac{g}{L}$

$= \boxed{2.0 \frac{g}{L}}$

② convert V to cm^3, then calculate D.

$L \rightarrow mL \rightarrow cm^3$

$1mL = 10^{-3}L$

$1cm^3 = 1mL$

$1.5L \left(\frac{1mL}{10^{-3}L}\right)\left(\frac{1cm^3}{1mL}\right)$

$= 1.5 \times 10^3 cm^3$

$D = \frac{m}{V} = \frac{2.98 \times 10^3 g}{1.5 \times 10^3 cm^3}$

$D = 1.98\ g/cm^3$

$= \boxed{2.0\ g/cm^3}$

☐ **Use density as a conversion factor**

1. What is the volume in mL of 345.8g of a liquid with a density of 1.15 g/mL?

Given: $m = 345.8g$

$D = 1.15\ g/mL$

Need: V in mL

CF: $m \rightarrow V$

$D = 1.15\ g/mL$

$1.15g = 1mL$

$345.8g \left(\frac{1mL}{1.15g}\right) = 300.696mL$

$= \boxed{300.7mL}$

2. What is the mass of 20 L of ethanol given that the density of ethanol is $0.789 g/cm^3$?

Given: 20L

Need: mass

$L \rightarrow mL \rightarrow cm^3 \rightarrow g$

CF: $1mL = 10^{-3}L$

$1mL = 1cm^3$

$0.789g = 1cm^3$

$20L \left(\frac{1mL}{10^{-3}L}\right)\left(\frac{1cm^3}{1mL}\right)\left(\frac{0.789g}{1cm^3}\right) =$

$= 1.578 \times 10^4 g$

$= \boxed{2 \times 10^4 g}$

I technically only get 1 sig fig because of the 20