Chem.15
Dr. Song

Exercise:
(Physical Measurements)

(Do this exercise on separate sheet and show your work for credit.)

1. Fill in the blanks: Measurements in the SI/metric system.

	Base quantities					Derived quantities	
	mass	length	time	temp	chem.amt.	volume	density
base unit	Kilogram	meter	Second	Kelvin	mole	$m \times m \times m$	$kg \div m^3$
abbrev'n	Kg	m	s	K	mol	m^3	$\frac{Kg}{m^3}$

2. SI/metric prefixes: fill in the blanks:

	mega	kilo	deci	centi	milli	micro	nano
symbol	M	K	d	C	m	μ	n
exponential form	10^6	10^3	10^{-1}	10^{-2}	10^{-3}	10^{-6}	10^{-9}

3. Using the following equations---

$T°_C = (T°_F - 32°) / 1.8$ $\quad T°_F = 1.8\ T°_C + 32$ $\quad T_K = T°_C + 273.15$

a) 98.6 °C = 209 °F
b) 450°F = 232 °C
c) -12.5°F = -24.7 °C
d) 273°C = 546 K
e) 0.0 K = -273.2 °C
f) 298 K = 77 °F

4. Make the following conversions: use exponential notation when appropriate.

a) 225 g = 0.225 kg = 2.25×10^5 mg
b) 85.0 mg/L = 0.0850 g/L = 8.50×10^4 µg/L
c) 250 mL = 0.250 L = 2.50 dL
d) 0.00075 L = 7.5×10^{-3} dL = 0.75 mL
e) 1.00 mL = 1.00 cm^3

5. How many significant figures are there in ...

a) 200.5 kg 4
b) 0.005 g 1
c) 5.00 mg 3
d) 0.0050 g 2

6. Round off to 3 sig fig and express in scientific notation:
   a) 19890 ft 1.99×10^4 ft
   b) 0.056721 g 5.67×10^{-2} g
   c) 45820 4.58×10^4
   d) 0.00000060039 m 6.00×10^{-7} m

7. What is the difference, if any, between "0.04 m" and "0.0400. m"? How would you express these measurements using scientific notation?

8. Round each of the following, 68375, 96.518, and 0.014535 to a) three significant figures, b) four significant figures and
   (a) 68400, 0.0145 (b) 68380, 0.01454

9. Perform the following arithmetical operations, giving proper number of sig. fig. (and units) to your answer:

   a) 27.5 m + 0.0055 m = 27.5 m
   b) 27.5 m x 0.0055 m = $0.15\ m^2$
   c) 27.524 g/9.90 mL = 2.78 g/mL
   d) $37.5\ m^3/(6.245 \times 10^2\ m^2)$ = 0.0589 m

10. Convert the following using appropriate conversion factor. Show the dimension in your calculation.

   (a) 2155 lb = 979.5 kg
   (b) 16.0 oz = 453 g

11. Which of the masses in each of the following pairs is larger?
   a) (0.1 g) or 10 mg
   b) ~~1 kg~~ or (10000 g)
   c) 1 pound or (0.5 kg) (1 kg = 2.2 pounds)

12. Circle the larger volume in each of the folowing pairs.
   a) (1 cubic meter) or 1 litre
   b) 1 millilitre or (1 litre)
   c) 1 litre or (1 gallon)
   d) 0.010 litre or (100 mL)

13. The density of a solution was determined four times and the results are listed as follows:

Measurement	Density (g/mL)
1	1.079
2	1.082
3	1.076
4	1.080

a) What is the average (mean) density? Average deviation from the mean?

$\bar{X}(av.) = 1.079\ g/mL, \quad \bar{d} = 0.002$

b) If the density is theoretically 1.032 g/mL, what is the % error?

4.6 %

14. Perform the following conversions:
   a) 15.5 pounds to kg and mg units. 7.04 Kg ; 7.04×10^6 mg
   b) 11.5 inches to m and cm units. 0.292 m ; 29.2 cm
   c) 1.0 m^3 to in^3. 6.1×10^4 in^3

15. Complete the following density problems, using conversion factors.

substance	density of the substance	mass	volume
aluminum	2.7 g/cm^3	7590 g	a block 45 cm long 25 cm wide and 2.5 cm thick
methyl alcohol	0.801 g/mL	10.0 g	12.5 mL
lead	11.35 g/cm^3	1.99×10^3 g	175 cm^3

@ Exercises from the Text (Peter/Cracolice, 2nd ed.,2004):
   * 3.53 (p 88)
   * 3.55 (p 88)

3.53, p88 :

$$12.0\ fl.oz \times \frac{1\ qt}{32\ fl.oz} \times \frac{1\ gal}{4\ qt} \times \frac{1\ ft^3}{7.48\ gal} \times \frac{64.4\ lb}{1\ ft^3} \times \frac{454\ g}{1\ lb} = 366\ g$$

3.55, p88 :

$$0.25\ cup \times \frac{0.25\ qt}{1\ cup} \times \frac{1\ L}{1.06\ qt} \times \frac{1000\ mL}{1\ L} \times \frac{1\ cm^3}{1\ mL} \times \frac{0.86\ g}{1\ cm^3} = 51\ g$$