CHEM 130 **Name**_____
Quiz 3 **Due by 5:00 PM, Friday September 8.**

These are typical problems involving unit conversion, the metric system, percentage calculations, etc. You may use your book, **but you may not seek help from anyone other than Dr. Lamp**. As you work these problems remember to keep track of units and be sure that every answer has the correct units and significant figures. Clearly mark your answers.

1. Two elements, R and Q combine to form two binary compounds. In the first compound, 14.0g R combines with 3.00g of Q. In the second compound, 7.00g of R combines with 4.50g of Q.
   a. Show whether these data are in agreement with the law of multiple proportions. (4 pts.)
   One approach would be to first calculate the mass ratios for each compound:

$$\text{Compound 1}\ \frac{14.0\text{ g R}}{3.00\text{ g Q}} = 4.67 \qquad \text{Compound 2}\ \frac{7.00\text{ g R}}{4.50\text{ g Q}} = 1.56$$

   If the law of multiple proportions holds, the ratio of these mass ratios should be a small, whole number.

$$\frac{4.67}{1.56} = 2.999 = 3$$

   So, this agrees with the law of multiple proportions.

   b. If the formula for the second compound is RQ, what is the formula for the first compound? (4 pts)

   Based on the ratio of mass ratios above, compound 1 has three times as much R per gram of Q as compound 2 has. Therefore, there must be three times as many atoms of R per atom of Q. If compound 2 is RQ, compound 1 must be R_3Q.

2. Complete the following table: (8 pts)

Symbol	# protons	# neutrons	# electrons	net charge
$^{238}_{92}U$	92	146	92	0
$^{40}_{20}Ca^{2+}$	20	20	18	+2
$^{51}_{23}V^{3+}$	23	28	20	+3
$^{89}_{39}Y$	39	50	39	0
$^{78}_{34}Se^{2-}$	34	44	36	-2
$^{31}_{15}P^{3-}$	15	16	18	-3

3. The two naturally occurring isotopes of copper have masses of 62.9296 amu and 64.9278 amu. Determine the percentage of copper-65 (^{65}Cu) in naturally occurring copper (8 pts)

Since only two isotopes exist:

$$f_{63} + f_{65} = 1 \text{ and}$$

$$62.9296f_{14} + 15.0001f_{15} = 63.546 \text{ (This is our definition of atomic mass)}$$

So

$$f_{63} = 1 - f_{65}$$

$$62.9296(1 - f_{65}) + 64.9278\, f_{65} = 63.546$$

$$62.9296 - 62.9296\, f_{65} + 64.9278\, f_{65} = 63.546$$

$$(64.9278 - 62.9296)\, f_{65} = 63.546 - 62.9296$$

$$1.9982\, f_{65} = 0.6164$$

$$f_{65} = 0.3085$$

$$\%^{65}Cu = 100\% \times 0.3085 = 30.85\%$$

You could also calculate f_{63} and determine f_{65} from $1 = f_{63} + f_{65}$