Ch 7 Math Notes

How do you determine formula mass (amu) and molar/molecular/empirical formula mass (g/mol)?

Multiply the atomic mass of each element by the number of atoms/moles in the compound.
Ex $C_6H_{12}O_6$

Element	# of atoms/moles	molar mass of element	total mass of element in compound
C	6	12.0	72.0
H	12	1.00	12.0
O	6	16.0	96.0

Molar mass for the compound is the sum of the totals for all elements 72.0 + 12.0 + 96.0 = 180.0 $C_6H_{12}O_6$

How do you determine %(percent) composition?

Divide $\frac{\text{Mass of element in compound}}{\text{Mass of compound}}$ Then multiply by 100%

Ex % composition carbon in $C_6H_{12}O_6$: $\%C = \frac{72.0\text{ g/mol C}}{180.0\text{ g/mol}} \times 100\% = 40\%$

How do you convert from grams → moles? Divide mass of sample by molar mass
Ex. How many moles are in 40.0g C? $40.0\text{ g C} \times \frac{1\text{mol C}}{12.0\text{g C}} = 3.33\text{ mol C}$

How do you determine empirical formula from percent composition?
Assume you have a 100.0g sample so you can use your percentages as grams. Determine how many moles of each element would be present. Set up a ratio of all the elements and divide each part by the smallest number. (You may need to multiple all the numbers in the ratio by a common factor to get a whole number ratio.) Use the numbers in the ratio as the subscripts in the chemical formula.

Ex. What is the empirical formula of a compound that is 40.0% C, 6.67% H, and 53.33% O?

$6.67\text{ g H} \times \frac{1\text{ mol H}}{1.00\text{g H}} = 6.67\text{ mol H}$ $53.33\text{ g O} \times \frac{1\text{mol}}{16.0\text{ g O}} = 3.33\text{ mol O}$

Ratio of C:H:O is $\frac{3.33}{3.33} : \frac{6.67}{3.33} : \frac{3.33}{3.33}$. Divide all by smallest # (3.33)

Ratio is 1:2:1 empirical formula is CH_2O

How do you determine molecular formula from empirical formula and molecular mass?
Calculate empirical formula mass. Divide molecular mass by empirical formula mass. Multiply all the subscripts in the empirical formula by this factor.
Ex What is the molecular formula of a compound whose empirical formula is CH_2O and molecular mass is 180g/mol?

C	1 x 12.0 = 12.0	12.0 + 2.0 + 16.0 = 30.0g/mol	$\frac{180\text{g/mol}}{30.0\text{g/mol}} = 6$
H	2 x 1.0 = 2.0		
O	1 x 16.0 = 16.0		

When you multiply all the subscripts in CH_2O by 6, you get the molecular formula $C_6H_{12}O_6$.