

(2) 500. g

$$\times \frac{1 \text{ cork}}{1.63 \text{ g}} = \underline{306} \text{ corks}$$

307, if you round but you would have less than 307.

$$500. \text{ g} \times \frac{1 \text{ stopper}}{4.31 \text{ g}} = \underline{116} \text{ stoppers}$$

strategy: 1.00 kg corks \rightarrow g of corks \rightarrow # of corks. Then, #corks = #stoppers.
Then, turn # of stoppers into g of stoppers.

$$1.00 \text{ kg} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ cork}}{1.63 \text{ g}} = \underline{613.497} \text{ corks}$$

$$613.497 \text{ corks} = 613.497 \text{ stoppers} \times \frac{4.31 \text{ g}}{1 \text{ stopper}} = \underline{2640} \text{ grams of stoppers}$$

(4) We have to use the average because the atoms of an element do not all have the same mass. Each isotope has its own mass. We can use the average mass because any sample of an element in nature (more or less) has the same distribution of isotopes & thus has the same average mass per atom.

(6) (a) $10.81 \text{ amu boron} \times \frac{1 \text{ atom}}{10.81 \text{ amu}} = \underline{1} \text{ atom B}$

(c) $19697 \text{ amu Au} \times \frac{1 \text{ atom Au}}{1970 \text{ amu Au}} = \underline{100} \text{ atoms Au}$

(9) 6.02×10^{23}

(11) $57.0 \text{ g F}_2 \times \frac{1 \text{ mol}}{38.0 \text{ g}} = 1.50 \text{ mol F}_2 \times \frac{2 \text{ mol F atoms}}{1 \text{ mol F}_2} = \underline{3.00} \text{ mol of atoms}$

Fluorine occurs as F_2 , not F.

$3.00 \text{ mol Co} \times \frac{58.93 \text{ g}}{1 \text{ mol Co}} = \underline{177} \text{ g Co}$

(13) $0.50 \text{ mol O atoms} \times \frac{16.0 \text{ g}}{1 \text{ mol}} = 8.00 \text{ g}$
 $4 \text{ mol H atoms} \times \frac{1.01 \text{ g}}{1 \text{ mol}} = 4.04 \text{ g}$

← 0.5 mol O weighs more

(14) (a) $26.2 \text{ g Au} \times \frac{1 \text{ mol}}{197 \text{ g}} = 0.133 \text{ mol}$

(c) $335 \text{ mg Ba} \times \frac{1 \text{ g}}{1000 \text{ mg}} \times \frac{1 \text{ mol}}{137.3 \text{ g}} = \frac{0.00244 \text{ mol}}{2.44 \times 10^{-3} \text{ mol}}$

(e) $3.05 \times 10^{-5} \text{ } \mu\text{g Ni} \times \frac{1 \text{ g}}{10^6 \text{ } \mu\text{g}} \times \frac{1 \text{ mol}}{58.69 \text{ g}} = \frac{5.20 \times 10^{-13} \text{ mol}}{5.20 \times 10^{-13} \text{ mol}}$

(15) (a) $2.00 \text{ mol Fe} \times \frac{55.85 \text{ g}}{1 \text{ mol}} = 112 \text{ g Fe}$

(c) $1.23 \times 10^{-3} \text{ mol Pt} \times \frac{195.1 \text{ g}}{1 \text{ mol}} = 0.240 \text{ g Pt}$

(e) $0.00102 \text{ mol Mg} \times \frac{24.31 \text{ g Mg}}{1 \text{ mol Mg}} = 0.0248 \text{ g Mg}$

(16) (a) $0.00103 \text{ g} \times \frac{1 \text{ mol}}{58.93 \text{ g}} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol}} = 1.05 \times 10^{19} \text{ atoms Co}$

(c) $2.75 \text{ g Co} \times \frac{1 \text{ mol}}{58.93 \text{ g}} = 0.0467 \text{ mol Co}$

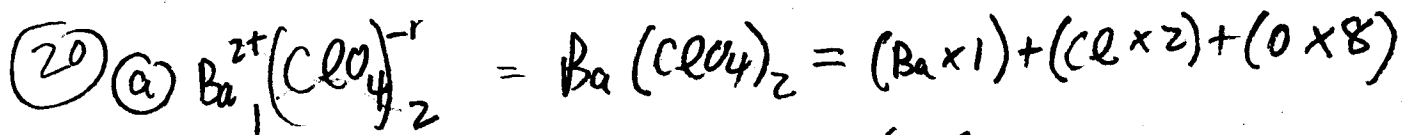
(e) $4.23 \text{ mol Co} \times \frac{58.93 \text{ g}}{1 \text{ mol}} = 249 \text{ g Co}$

(18) averaging

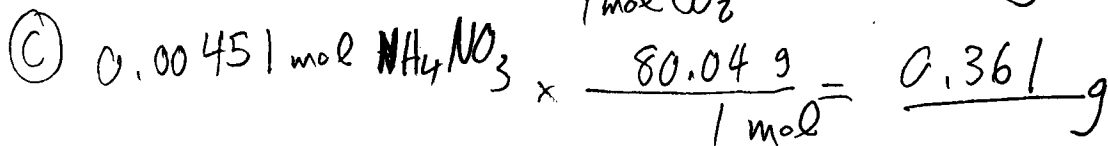
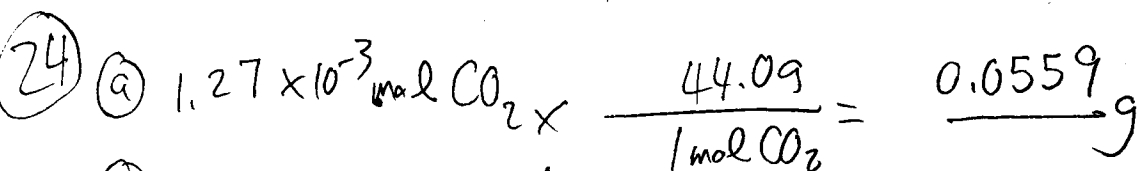
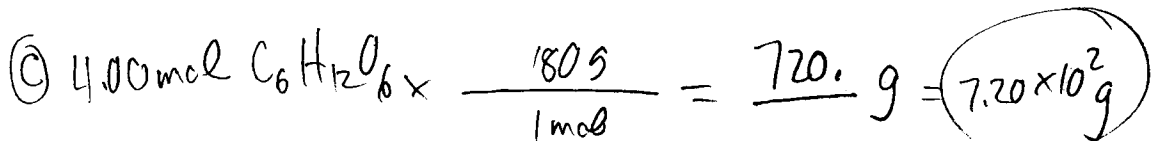
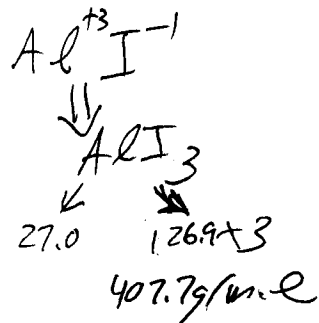
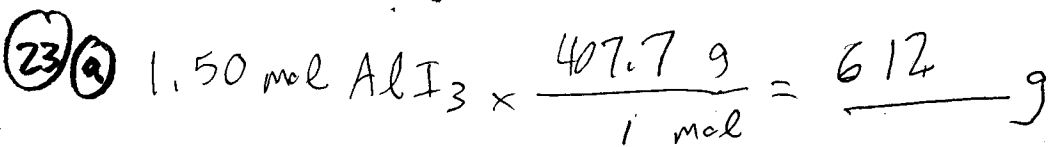
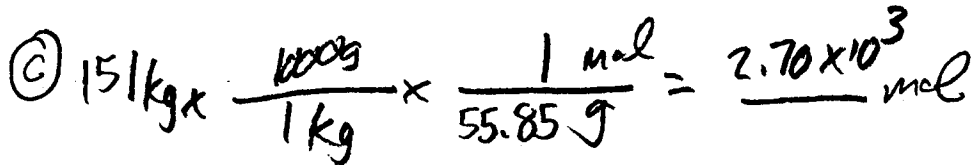
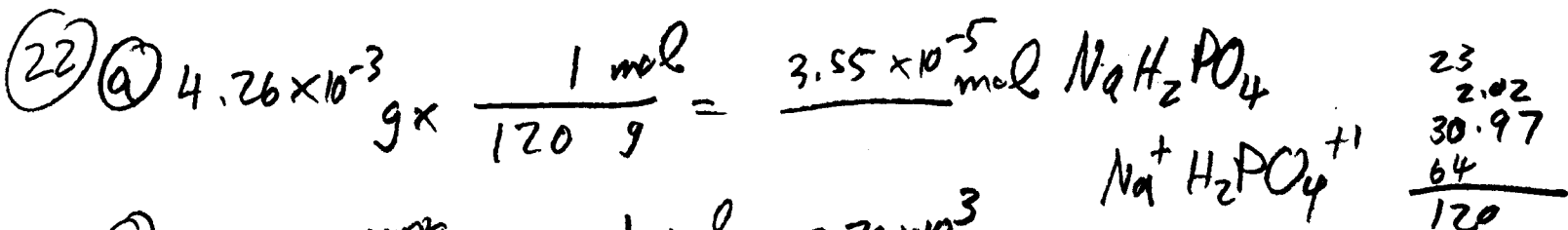
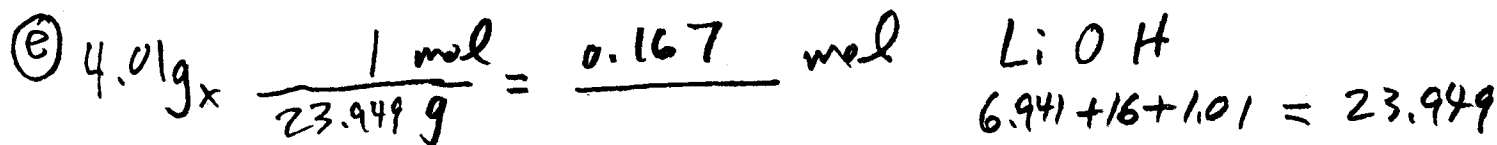
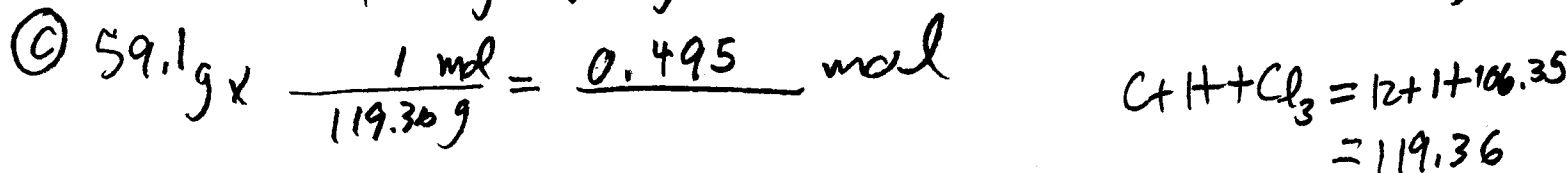
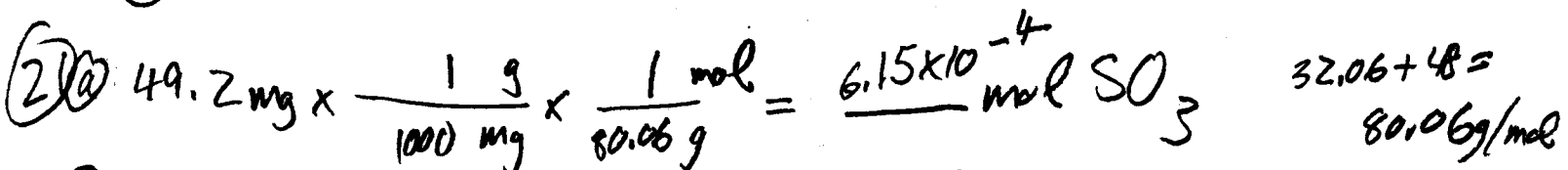
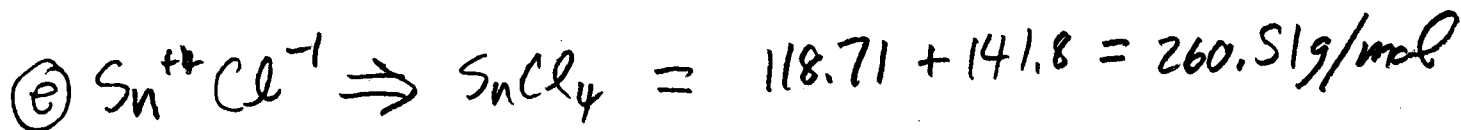
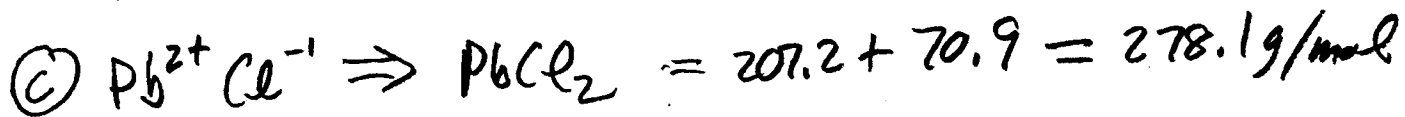
(19) $(\text{Na} \times 3) + (\text{N} \times 1) = (23 \times 3) + (14 \times 1) = 83.0 \text{ g/mol}$

(c) $\text{NH}_4\text{Br} = 14 + 4.04 + 79.9 = 97.9 \text{ g/mol}$

(e) $\text{H}_2\text{SO}_3 = 2.02 + 32.1 + 48 = 82.1 \text{ g/mol}$



$137.3 + 70.9 + 128 = 336.2 \text{ g/mol}$



Ch. 6 problems, p. 189

(25) a) $6.37 \text{ mol CO}_2 \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = 3.83 \times 10^{24} \text{ molecules}$

(c) $2.62 \times 10^{-6} \text{ g H}_2\text{O} \times \frac{1 \text{ mol}}{18.0 \text{ g}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = 8.76 \times 10^{16} \text{ molecules}$

(26) a) $2.01 \text{ g Na}_2\text{SO}_4 \times \frac{1 \text{ mol Na}_2\text{SO}_4}{142.1 \text{ g Na}_2\text{SO}_4} \times \frac{1 \text{ mol S atoms}}{1 \text{ mol Na}_2\text{SO}_4} = 0.0141 \text{ moles}$
 $(23 \times 2) + (32.1) + (64) =$

(c) $2.01 \text{ g Na}_2\text{S} \times \frac{1 \text{ mol Na}_2\text{S}}{78.06 \text{ g Na}_2\text{S}} \times \frac{1 \text{ mol S}}{1 \text{ mol Na}_2\text{S}} = 0.0257 \text{ mol S}$
 $(23 \times 2) + 32.1 =$

(27) a) $\text{Na}_2\text{SO}_4 = (23 \times 2) + (32.1) + (4 \times 16) = 142.1 \text{ g/mol}$

$\% \text{Na} = \frac{46}{142.1} \times 100 = 32.4\% \text{ Na}$ $\% \text{S} = \frac{32.1}{142.1} \times 100 = 22.6\% \text{ S}$ $\% \text{O} = \frac{64}{142.1} \times 100 = 45.0\% \text{ O}$

(c) $\text{Na}_2\text{S} = (23 \times 2) + 32.1 = 78.1 \text{ g/mol}$

$\% \text{Na} = \frac{46}{78.1} \times 100 = 58.9\%$ $\% \text{S} = \frac{32.1}{78.1} \times 100 = 41.1\%$

(e) $\text{K}_3\text{PO}_4 = (39.1 \times 3) + 31 + 64 = 212.3$

$\% \text{K} = \frac{117.3}{212.3} \times 100 = 55.3\% \text{ K}$ $\% \text{P} = \frac{31}{212.3} \times 100 = 14.6\% \text{ P}$ $\% \text{O} = \frac{64}{212.3} \times 100 = 30.1\% \text{ O}$

Ch. 6 problems, p. 189

(27) (g) $KH_2PO_4 = 39.1 + 2.02 + 31.0 + 64 = 136.12$

$$\%K = \frac{39.1}{136.12} \times 100 \quad \%H = \frac{2.02}{136.12} \times 100 \quad \%P = \frac{31}{136.12} \times 100 \quad \%O = \frac{64}{136.12}$$

$$\%K = 28.7\% \quad \%H = 1.48\% \quad \%P = 22.8\% \quad \%O = 47.0\%$$

(28) (a) $\%Cu = \frac{63.55}{223.35} \times 100 = 28.5\% Cu$

(c) $\%Fe = \frac{55.85}{126.75} \times 100 = 44.0\% Fe$

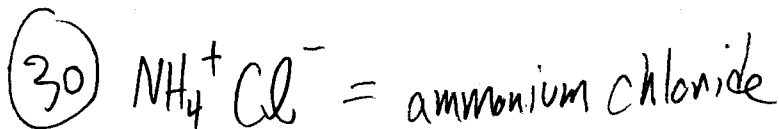
(e) $\%Co = \frac{58.93}{312.73} \times 100 = 18.8\% Co$

(g) $\%Sn = \frac{118.71}{150.71} \times 100 = 78.8\%$

(29) (a) $\%C = \frac{(6 \times 12)}{(6 \times 12) + (10 \times 1.01) + (4 \times 16)} \times 100 = 49.3\% C$

(c) $\%C = \frac{(8 \times 12)}{(8 \times 12) + (10 \times 1.01) + (4 \times 14) + (2 \times 16)} \times 100 = 49.5\% C$

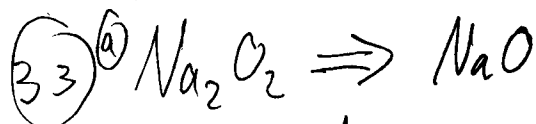
(e) $\%C = \frac{(6 \times 12)}{(6 \times 12) + (11 \times 1.01) + (16) + 1.01} \times 100 = \frac{72}{100.12} \times 100 = 71.9\% C$



(a) $\frac{\text{mass of } NH_4^+}{\text{total mass}} \times 100 = \frac{18.04}{53.49} \times 100 = 33.7\% \text{ ammonium}$

(c) $AuCl_3 \Rightarrow \%Au^{3+} = \frac{196.97}{(196.97) + (3 \times 35.45)} \times 100 = \frac{64.9}{107.32} \% \text{ gold}$

32 empirical formula: simplest whole-number ratio of atoms
 molecular formula: actual # of atoms of each element in a compound



b) $\text{C}_{12}\text{H}_{12}\text{N}_2\text{O}_3 \Rightarrow$ same; you can't divide all of the subscripts by any integer but one ("1")

34) a) yes, they both have E.F. of CH

c) yes, they both have E.F. of NO_2

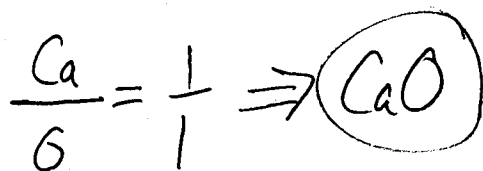
36) $\text{Ca} = 2.514\text{g}$

Calcium oxide = $2.514\text{g} + 1.004\text{g}$ ↙ mass of oxygen

$2.514\text{g Ca} \times \frac{1 \text{ mol Ca}}{40.1 \text{ g Ca}} = 0.0627 \text{ mol Ca}$

$\text{Ca} = 0.0627$ $\text{O} = 0.0628$

$1.004\text{g O} \times \frac{1 \text{ mol O}}{16.0 \text{ g O}} = 0.0628 \text{ mol O}$

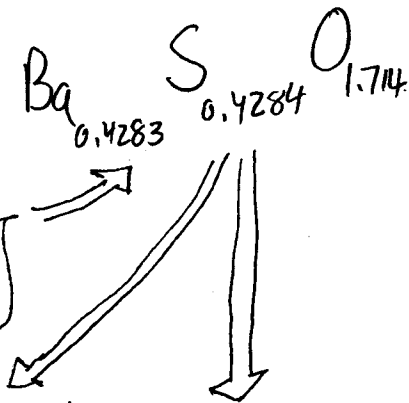


37) Assume 100g:

$58.84 \text{ g Ba} \times \frac{1 \text{ mol Ba}}{137.38 \text{ g Ba}} = 0.4283 \text{ mol Ba}$

$13.74 \text{ g S} \times \frac{1 \text{ mol S}}{32.07 \text{ g S}} = 0.4284 \text{ mol S}$

$27.43 \text{ g O} \times \frac{1 \text{ mol O}}{16.0 \text{ g O}} = 1.714 \text{ mol O}$



$\frac{\text{Ba}}{\text{S}} = \frac{1}{1}$ $\frac{\text{O}}{\text{Ba}} = \frac{1.714}{0.4283} = \frac{4}{1}$

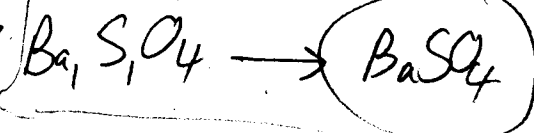
39) 55.06% Co \Rightarrow total mass = 100%

$55.06 \text{ g Co} \times \frac{1 \text{ mol Co}}{58.93 \text{ g Co}} = 0.9343 \text{ mol Co}$

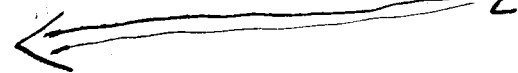
%S = $100 - 55.06 = 44.94\%$

$44.94 \text{ g S} \times \frac{1 \text{ mol S}}{32.07 \text{ g S}} = 1.401 \text{ mol S}$

$\frac{\text{S}}{\text{Co}} = \frac{1.401}{0.9343} = 1.5 = \frac{3}{2}$

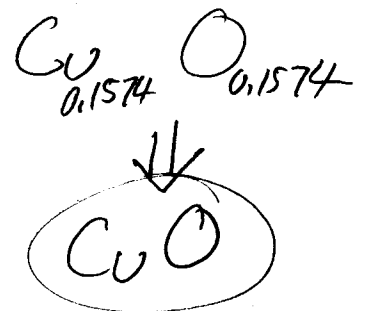


Co_2S_3



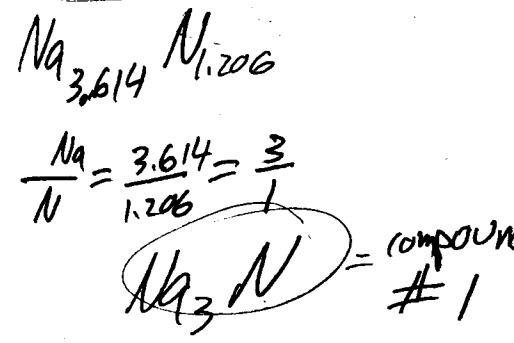
41) 10.0g Cu
2.52g O

10.0g Cu x $\frac{1 \text{ mol}}{63.55 \text{ g}} = 0.1574 \text{ mol Cu}$
 2.52g O x $\frac{1 \text{ mol}}{16.00 \text{ g}} = 0.1575 \text{ mol O}$



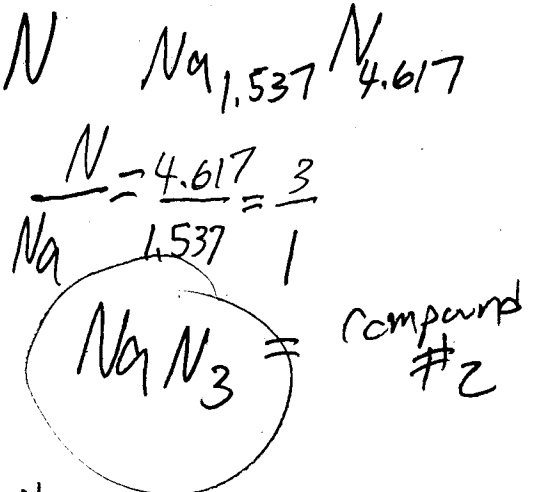
43) a) 83.12g Na

83.12g Na x $\frac{1 \text{ mol}}{23 \text{ g}} = 3.614 \text{ mol Na}$
 16.88g N x $\frac{1 \text{ mol}}{14 \text{ g}} = 1.206 \text{ mol N}$



b) 35.36g Na

35.36g Na x $\frac{1 \text{ mol}}{23 \text{ g}} = 1.537 \text{ mol Na}$
 64.64g N x $\frac{1 \text{ mol}}{14 \text{ g}} = 4.617 \text{ mol N}$

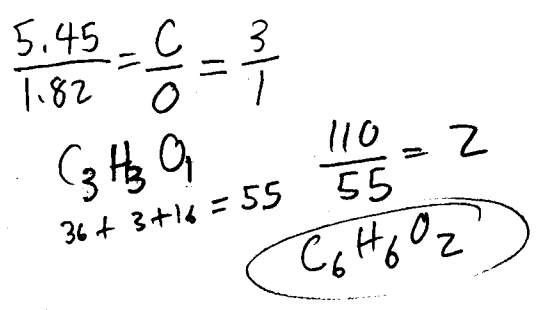


45) Poorly-worded & contradictory question, don't you think? Let's try again:

"What other piece of information do we need in order to determine the molecular formula if the empirical formula is known?" Answer: the molar mass.

48) CH₄O = 12 + 4 + 16 = 32 $\frac{192}{32} = 6$ C₆H₂₄O₆

50) 65.45g C x $\frac{1 \text{ mol}}{12 \text{ g}} = 5.45 \text{ mol C}$
 5.492g H x $\frac{1 \text{ mol}}{1.01 \text{ g}} = 5.44 \text{ mol H}$



29.06g O x $\frac{1 \text{ mol}}{16 \text{ g}} = 1.82 \text{ mol O}$