

MATTER & MINERALSCHEMISTRY HOMEWORK - FALL - WEEK 3.Chapter 2

- (77) (a) $Pb(C_2H_3O_2)_2$ lead(II) acetate
 (b) $CuSO_4$ copper(II) sulfate
 (c) CaO calcium oxide
 (d) $MgSO_4$ magnesium sulfate
 (e) $Mg(OH)_2$ magnesium hydroxide
 (f) $CaSO_4$ calcium sulfate
 (g) N_2O dinitrogen monoxide

- (78) (a) possible candidates O, S, Se, Te, Po
 their stable ions O^{2-} S^{2-} Se^{2-} Te^{2-} ~~Po~~
 # of electrons 10 18 36 54

∴ element is Te

- (b) alkali metals Li Na K Rb Cs Fr
 stable ion Li^+ Na^+ K^+ Rb^+ Cs^+ Fr^+
 # of electrons 2 10 18 36 54 86

rubidium

- (c) Noble gases He, Ne, Ar, Kr, Xe, Rn
 # of protons 2 10 18 36 54 86
~~mass # 4 20 40 84~~
~~# of neutrons 2 10 22 48~~

element is argon

(d) halogens	F,	Cl,	Br,	I,	At
# of protons	9	17	35	53	85

element is At (astatine)

(82)	phosphorus compounds	name
	Na_3PO_4	sodium phosphate
	H_3PO_4	phosphoric acid
	$\text{Mg}_3(\text{PO}_4)_2$	magnesium phosphate
	By analogy;	
	Na_3AsO_4	sodium arsenate
	H_3AsO_4	arsenic acid
	$\text{Mg}_3(\text{SbO}_4)_2$	magnesium antimonate

Chapter 3

$$\begin{aligned} & (1.40 \times 203.973) \text{ amu} + (24.10 \times 205.9745) \text{ amu} + \\ & (22.10 \times 206.9759) \text{ amu} + (52.40 \times 207.9766) \text{ amu} \\ & \hline & \quad \quad \quad 100 \\ & = 207.22 \text{ amu} = \underline{\underline{207 \text{ amu}}} \end{aligned}$$

$$(28) \quad 500.0 \text{ g Fe} \times \left(\frac{\text{mol}}{55.85 \text{ g}} \right) = \underline{\underline{8.953 \text{ mol Fe}}}$$

$$8.953 \text{ mol Fe} \times \left(\frac{6.02 \times 10^{23} \text{ atoms Fe}}{1 \text{ mol Fe}} \right) = \underline{\underline{5.389 \times 10^{24} \text{ Fe atoms}}}$$

$$(30) \quad 5.0 \times 10^{21} \text{ atoms C} \times \left(\frac{1 \text{ mol C}}{6.02 \times 10^{23} \text{ atoms}} \right) = \underline{\underline{8.3 \times 10^{-3} \text{ mol C}}}$$

$$8.3 \times 10^{-3} \text{ mol C} \times \left(\frac{12.01 \text{ g}}{1 \text{ mol C}} \right) = \underline{\underline{9.9 \times 10^{-2} \text{ g C}}}$$

$$(31) \quad \text{Al}_2\text{O}_3 = 2(\text{Al}) + 3(\text{O}) = 2(26.98 \text{ g/mol}) + 3(16.00 \text{ g/mol}) \\ = \underline{\underline{101.96 \text{ g/mol}}}$$

$$\text{Na}_3\text{AlF}_6 = 3(\text{Na}) + \text{Al} + 6(\text{F}) \\ = 3(22.99 \text{ g/mol}) + 26.98 \text{ g/mol} + 6(19.00 \text{ g/mol}) \\ = \underline{\underline{209.95 \text{ g/mol}}}$$

$$(34) \quad (a) \text{P}_4\text{O}_6 = 4(\text{P}) + 6(\text{O}) = 4(30.97 \text{ g/mol}) + 6(16.00 \text{ g/mol}) \\ = \underline{\underline{219.88 \text{ g/mol}}}$$

$$(b) \text{Ca}_3(\text{PO}_4)_2 = 3(\text{Ca}) + 2(\text{P}) + 8(\text{O}) \\ = [3(40.08) + 2(30.97) + 8(16.00)] \text{ g/mol} \\ = \underline{\underline{310.18 \text{ g/mol}}}$$

d/

$$\begin{aligned}
 \text{(c) } \text{Na}_2\text{HPO}_4 &= 2(\text{Na}) + \text{H} + \text{P} + 4(\text{O}) \\
 &= [2(22.99) + 1.008 + 30.97 + 4(16.00)] \text{ g/mol} \\
 &= \underline{\underline{141.96 \text{ g/mol}}}
 \end{aligned}$$

$$\begin{aligned}
 \text{(H5) Vitamin C} &= \text{C}_6\text{H}_8\text{O}_6 = 6(\text{C}) + 8(\text{H}) + 6(\text{O}) \\
 &= [6(12.01) + 8(1.008) + 6(16.00)] \text{ g/mol} \\
 &= \underline{\underline{176.12 \text{ g/mol}}}
 \end{aligned}$$

$$\begin{aligned}
 500.0 \text{ mg} &= 500.0 \text{ mg} \times \left(\frac{1 \text{ g}}{10^3 \text{ mg}} \right) \times \left(\frac{1 \text{ mol}}{176.12 \text{ g}} \right) \\
 &= \underline{\underline{2.839 \times 10^{-3} \text{ mol}}}
 \end{aligned}$$

$$\begin{aligned}
 2.839 \times 10^{-3} \text{ mol} &\times \frac{6.02 \times 10^{23} \text{ vit. C molecules}}{1 \text{ mol}} \\
 &= \underline{\underline{1.709 \times 10^{21} \text{ Vitamin C molecules}}}
 \end{aligned}$$

$$\begin{aligned}
 \text{(H6) (a) Aspirin} &= \text{C}_9\text{H}_8\text{O}_4 = 9(\text{C}) + 8(\text{H}) + 4(\text{O}) \\
 &= [9(12.01) + 8(1.008) + 4(16.00)] \text{ g/mol} \\
 &= 180.15 \text{ g/mol} = \underline{\underline{180.2 \text{ g/mol}}}
 \end{aligned}$$

$$\text{(b) } 500 \text{ mg} \times \frac{10^3 \text{ g}}{1 \text{ mg}} \times \frac{\text{mol}}{180.2 \text{ g}} = \underline{\underline{2.77 \times 10^{-3} \text{ mol}}}$$

$$4.63 \times 10^{-3} \text{ mol} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = \underline{\underline{1.67 \times 10^{21} \text{ molecules}}}$$

e/

$$\textcircled{47} \quad (a) \quad 2.49 \times 10^{20} \text{ molecules} \times \frac{1 \text{ mol CO}}{6.02 \times 10^{23} \text{ molecules}}$$

$$= \underline{\underline{4.14 \times 10^{-4} \text{ mol CO}}}$$

$$(b) \quad 15.0 \text{ g CuSO}_4$$

$$\text{molar mass of CuSO}_4 = [63.55 + 32.07 + 4(16.00)] \text{ g/mol}$$

$$= 159.62 \text{ g/mol}$$

$$15.0 \text{ g CuSO}_4 \times \frac{1 \text{ mol CuSO}_4}{159.62 \text{ g}} = \underline{\underline{9.39 \times 10^{-2} \text{ mol CuSO}_4}}$$

$$(c) \quad 100 \text{ molecules H}_2\text{SO}_4 \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecules}}$$

$$= \underline{\underline{1.66 \times 10^{-22} \text{ mol H}_2\text{SO}_4}}$$

$$(d) \quad 6.210 \text{ mg KI}$$

$$\text{molar mass of KI} = (39.10 + 126.9) \text{ g/mol}$$

$$= 166.0 \text{ g/mol}$$

$$6.210 \text{ mg KI} \times \frac{1 \text{ g}}{10^3 \text{ mg}} \times \frac{1 \text{ mol}}{166.0 \text{ g}} = \underline{\underline{3.741 \times 10^{-5} \text{ mol}}}$$

$$\textcircled{51} \quad (a) \quad \text{C}_{14}\text{H}_{18}\text{N}_2\text{O}_5 = 14(\text{C}) + 18(\text{H}) + 2(\text{N}) + 5(\text{O})$$

$$= [14(12.01) + 18(1.008) + 2(14.01) + 5(16.00)] \text{ g/mol}$$

$$= 294.304 \text{ g/mol} = \underline{\underline{294.3 \text{ g/mol}}}$$

$$(b) \quad 10.0 \text{ g aspartame} \times \frac{\text{mol}}{294.3 \text{ g}} = \underline{\underline{3.39 \times 10^{-2} \text{ mol}}}$$

$$(c) \quad 1.56 \text{ mol} \times \frac{294.3 \text{ g}}{1 \text{ mol}} = \underline{\underline{459 \text{ g}}}$$

$$(d) \quad 5.0 \text{ mg} \times \frac{\text{g}}{10^3 \text{ mg}} \times \frac{1 \text{ mol}}{294.3 \text{ g}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}}$$

$$= 1.0227 \times 10^{19} \text{ molecules} = \underline{\underline{1.0 \times 10^{19} \text{ molecules}}}$$

$$(e) \quad 1.2 \text{ g aspartame} \times \frac{1 \text{ mol aspartame}}{294.3 \text{ g}} \times \frac{2 \text{ mol N atoms}}{1 \text{ mol aspartame}}$$

$$= 8.2 \times 10^{-3} \text{ mol ~~N atoms~~} \times \left(\frac{6.02 \times 10^{23} \text{ N atoms}}{1 \text{ mol ~~N atoms~~} \right)$$

$$= \underline{\underline{4.9 \times 10^{21} \text{ N atoms}}}$$

$$(f) \quad \text{Mass of 1 mol of } \left. \begin{array}{l} \\ \text{aspartame} \end{array} \right\} = 294.3 \text{ g}$$

$$\therefore \text{ mass of 1 molecule} = \frac{294.3 \text{ g}}{6.02 \times 10^{23}}$$

$$= 4.89 \times 10^{-22} \text{ g}$$

$$\text{Mass of } 1.0 \times 10^9 \text{ molecules} = 1.0 \times 10^9 \times 4.89 \times 10^{-22} \text{ g}$$

$$= 4.89 \times 10^{-13} \text{ g}$$

$$= \underline{\underline{4.9 \times 10^{-13} \text{ g}}}$$

9)

$$(g) \quad \underline{\underline{4.89 \times 10^{-22} \text{ g}}}$$

$$\begin{aligned} (53) \quad \text{YBa}_2\text{Cu}_3\text{O}_7 &= \text{Y} + 2(\text{Ba}) + 3(\text{Cu}) + 7(\text{O}) \\ &= [88.91 + 2(137.3) + 3(63.55) + 7(16.00)] \text{ g/mol} \\ &= 666.16 \text{ g/mol.} \end{aligned}$$

$$\begin{aligned} \underline{\text{1 mol of YBa}_2\text{Cu}_3\text{O}_7 \text{ contains 1 mol Y}} \\ = 88.91 \text{ g of Y.} \end{aligned}$$

$$\text{frac} \quad 2 \text{ mol of Ba} = 2(137.3 \text{ g}) = 274.6 \text{ g Ba}$$

$$3 \text{ mol Cu} = 3(63.55) \text{ g} = 190.65 \text{ g Cu}$$

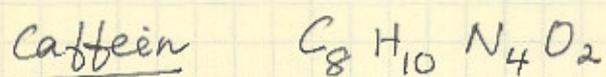
$$7 \text{ mol O} = 7(16.00) \text{ g} = 112.0 \text{ g O}$$

% by mass

Y	Ba	Cu	O
$\frac{88.91 \text{ g} \times 100\%}{666.16 \text{ g}}$	$\frac{274.6 \text{ g} \times 100\%}{666.16 \text{ g}}$	$\frac{190.65 \text{ g} \times 100\%}{666.16 \text{ g}}$	$\frac{112.0 \text{ g} \times 100\%}{666.16 \text{ g}}$
<u><u>13.35%</u></u>	<u><u>41.22%</u></u>	<u><u>28.62%</u></u>	<u><u>16.81%</u></u>

h/

(56)

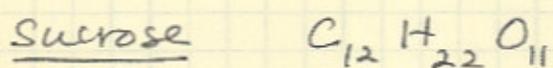


$$\begin{aligned} \text{Molar mass} &= [8(12.01) + 10(1.008) + 4(14.01) + 2(16.00)] \text{ g/mol} \\ &= 194.2 \text{ g/mol} \end{aligned}$$

1 mol of Caffeine has 8 mol of C

$$= 8 \times 12.01 \text{ g/mol C} = 96.08 \text{ g C}$$

$$\text{Mass \% C} = \frac{96.08 \text{ g}}{194.2 \text{ g}} \times 100\% = \underline{49.5\% \text{ C}}$$

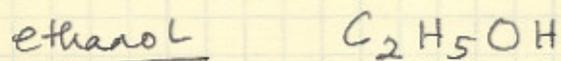


$$\begin{aligned} \text{Molar mass} &= [12(12.01) + 22(1.008) + 11(16.00)] \text{ g/mol} \\ &= 342.296 \text{ g/mol} \end{aligned}$$

1 mol sucrose contains 12 mol C

$$= 12 \text{ mol} \times \frac{12.01 \text{ g}}{\text{mol}} = 144.12 \text{ g C}$$

$$\text{Mass \% of C} = \frac{144.12 \text{ g}}{342.296 \text{ g}} \times 100\% = \underline{42.10\%}$$



$$\begin{aligned} \text{Molar mass of ethanol} &= [2(12.01) + 6(1.008) + 16.00] \text{ g/mol} \\ &= 46.07 \text{ g/mol} \end{aligned}$$

1 mol ethanol has 2 mol C = $2(12.01 \text{ g}) = 24.02 \text{ g C}$

$$\text{Mass \% C} = \frac{24.02 \text{ g}}{46.07 \text{ g}} \times 100\% = \underline{52.14\%}$$

