MATTER & MINERALS

CHEMISTRY 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

rubedium

(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
$Mg_3(PO_4)_2$	magnesium phosphate

By analogy;

Na_3AsO_4	sodium arsenate
H_3AsO_4	arsonic acid
$Mg_3(SbO_4)_2$	magnesium antimonate

Chapter 3

(22)

$$\frac{(1.40 \times 203.973)\text{amu} + (24.10 \times 205.9745)\text{amu} + (22.10 \times 206.9759)\text{amu} + (52.40 \times 207.9766)\text{amu}}{100}$$

$= 207.22 \text{ amu} =$ 207 amu

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

$8.953\ mol\ Fe \times \left(\frac{6.02\times10^{23}\ atoms\ Fe}{1\ mol\ Fe}\right) = \underline{5.389\times10^{24}\ Fe\ atoms}$

(30) $5.0\times10^{21}\ atoms\ C \times \left(\frac{1\ mol\ C}{6.02\times10^{23}\ atoms}\right) = \underline{8.3\times10^{-3}\ mol\ C}$

$8.3\times10^{-3}\ mol\ C \times \left(\frac{12.01\ g}{1\ mol\ C}\right) = \underline{9.9\times10^{-2}\ g\ C}$

(31) $Al_2O_3 = 2(Al) + 3(O) = 2(26.98\ g/mol) + 3(16.00\ g/mol)$

$= \underline{101.96\ g/mol}$

$Na_3AlF_6 = 3(Na) + Al + 6(F)$

$= 3(22.99\ g/mol) + 26.98\ g/mol + 6(19.00\ g/mol)$

$= \underline{209.95\ g/mol}$

(34) (a) $P_4O_6 = 4(P) + 6(O) = 4(30.97\ g/mol) + 6(16.00\ g/mol)$

$= \underline{219.88\ g/mol}$

(b) $Ca_3(PO_4)_2 = 3(Ca) + 2(P) + 8(O)$

$= [3(40.08) + 2(30.97) + 8(16.00)]\ g/mol$

$= \underline{310.18\ g/mol}$

d/

(c) Na_2HPO_4 = 2(Na) + H + P + 4(O)

$= [2(22.99) + 1.008 + 30.97 + 4(16.00)]$ g/mol

$= \underline{141.96 \text{ g/mol}}$

(45) Vitamin C = $C_6H_8O_6$ = 6(C) + 8(H) + 6(O)

$= [6(12.01) + 8(1.008) + 6(16.00)]$ g/mol

$= \underline{176.12 \text{ g/mol}}$

(46) $500.0 \text{ mg} = 500.0 \text{ mg} \times \left(\frac{1 \text{ g}}{10^3 \text{ mg}}\right) \times \left(\frac{1 \text{ mol}}{176.12 \text{ g}}\right)$

$= \underline{2.839 \times 10^{-3} \text{ mol}}$

$2.839 \times 10^{-3} \text{ mol} \times \frac{6.02 \times 10^{23} \text{ vit. C molecules}}{1 \text{ mol}}$

$= \underline{1.709 \times 10^{21} \text{ Vitamin C molecules}}$

(46) (a) Aspirin = $C_9H_8O_4$ = 9(C) + 8(H) + 4(O)

$= [9(12.01) + 8(1.008) + 4(16.00)]$ g/mol

$= 180.15 \text{ g/mol} = \underline{180.2 \text{ g/mol}}$

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

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

e/

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

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

(b) 15.0 g $CuSO_4$

molar mass of $CuSO_4 = [63.55 + 32.07 + 4(16.00)]$ g/mol

$= 159.62$ g/mol

$15.0 \text{ g } CuSO_4 \times \dfrac{1 \text{ mol } CuSO_4}{159.62 \text{ g}} = \underline{\underline{9.39 \times 10^{-2} \text{ mol } CuSO_4}}$

(c) 100 molecules $H_2SO_4 \times \dfrac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecules}}$

$= \underline{\underline{1.66 \times 10^{-22} \text{ mol } H_2SO_4}}$

(d) 6.210 mg KI

Molar mass of KI = (39.10 + 126.9) g/mol

= 166.0 g/mol

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

(51) (a) $C_{14}H_{18}N_2O_5 = 14(C) + 18(H) + 2(N) + 5(O)$

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

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

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

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

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

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

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

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

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

(f) Mass of 1 mol of aspartame $= 294.3\,g$

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

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

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

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

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

9)

(g) 4.89×10^{-22} g

(53) $Y Ba_2 Cu_3 O_7 = Y + 2(Ba) + 3(Cu) + 7(O)$

$= [88.91 + 2(137.3) + 3(63.55) + 7(16.00)]$ g/mol

$= 666.16$ g/mol.

1 mol of $Y Ba_2 Cu_3 O_7$ contains 1 mol Y

$= 88.91$ g of Y.

2 mol of Ba $= 2(137.3\ g) = 274.6$ g Ba

3 mol Cu $= 3(63.55)\ g = 190.65$ g Cu

7 mol O $= 7(16.00)\ g = 112.0$ g O

% by mass

Y	Ba	Cu	O
$\frac{88.91\ g}{666.16\ g} \times 100\%$	$\frac{274.6\ g}{666.16\ g} \times 100\%$	$\frac{190.65\ g}{666.16\ g} \times 100\%$	$\frac{112.0\ g}{666.16\ g} \times 100\%$
$= 13.35\%$	41.22%	28.62%	16.81%

h/

(56) Caffeine $C_8H_{10}N_4O_2$

Molar mass = $[8(12.01) + 10(1.008) + 4(14.01) + 2(16.00)]$ g/mol

= 194.2 g/mol

1 mol of Caffeine has 8 mol of C

= 8 × 12.01 g/mol C = 96.08 g C

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

Sucrose $C_{12}H_{22}O_{11}$

Molar mass = $[12(12.01) + 22(1.008) + 11(16.00)]$ g/mol

= 342.296 g/mol

1 mol Sucrose contains 12 mol C

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

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

ethanol C_2H_5OH

Molar mass of ethanol = $[2(12.01) + 6(1.008) + 16.00]$ g/mol

= 46.07 g/mol

1 mol ethanol has 2 mol C = 2(12.01 g) = 24.02 g C

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

Sucrose < Caffein < ethanol