Ch. 3 HW ~~9~~, ~~19~~, ~~21~~, ~~26~~, ~~31~~, ~~37~~, ~~43~~ ~~48~~, ~~50~~, ~~51~~, ~~57~~,
~~61~~, ~~62~~, ~~64~~, ~~69~~, ~~71~~, ~~79~~, ~~81~~, ~~89~~, ~~93~~, ~~102~~, ~~105~~, ~~107~~, ~~114~~

⑨ ⓐ $(NH_4)_3PO_4$ 149.09 g/mol
ⓑ CH_2Cl_2 85.02 g/mol
ⓒ $CuSO_4 \cdot 5H_2O$ 249.61 g/mol
ⓓ BrF_3 136.90 g/mol

⑲ ⓐ $$8.42\text{mol } Cr_2(SO_4)_2 \cdot 10H_2O \times \frac{476.32\text{g}}{1\text{mol}} = 4010.63\text{g} \quad \boxed{4.01 \times 10^3 \text{g}}$$

ⓑ $$1.83 \times 10^{24} \text{ molecules } Cl_2O_7 \times \frac{1\text{Mol}}{6.02 \times 10^{23} \text{ molecules}} \times \frac{182.9\text{g}}{1\text{Mol}} = 555.99\text{g} \quad \boxed{5.56 \times 10^2 \text{g}}$$

ⓒ $$6.2\text{g } Li_2SO_4 \times \frac{1 \text{ Mol}}{109.947\text{g}} \times \frac{6.02 \times 10^{23} \text{ formula units}}{1\text{Mol}} = \boxed{3.4 \times 10^{22} \text{ formula units}}$$

$$0.0564 \text{ mol} = \boxed{0.056 \text{ mol}}$$

ⓓ $$3.4 \times 10^{22} \text{ formula units} \times \frac{2\ Li^+ \text{ atoms}}{1 \text{ formula unit}} = \boxed{6.79 \times 10^{22} \text{ atoms } Li^+}$$

$$3.4 \times 10^{22} \text{ form units} \times \frac{1\ SO_4^{2-} \text{ ion}}{1 \text{ form. unit}} = \boxed{3.4 \times 10^{22}\ SO_4^{2-} \text{ ions}}$$

$$\boxed{3.4 \times 10^{22} \text{ S atoms}}$$

$$3.4 \times 10^{22} \text{ form units} \times \frac{4 \text{ atoms O}}{1 \text{ form unit}} - \boxed{1.36 \times 10^{23} \text{ atoms O}}$$

(21) (a) % I in strontium periodate $Sr(IO_4)_2$ $\frac{253.8}{469.42} \times 100 = \boxed{54.07\% I}$

(b) %Mn $KMnO_4$ $\frac{54.94}{158.0383} \times 100 = \boxed{34.76\%}$

(26) C_6SH_{10} (a) $2.63 \text{ mol} \times \frac{114.231 g}{1 mol} = \boxed{300.43 g}$

(b) $35.7 g \times \frac{1 mol}{114.231 g} \times \frac{6.02 \times 10^{23}}{1 mol} \times \frac{6 \text{ carbon atoms}}{1 \text{ molecule}} = \boxed{1.13 \times 10^{24} \text{ atoms } C}$

(31) iron as Fe^{2+} 0.33 mass % of hemoglobin

molar mass of hemoglobin = 6.8×10^4 g/mol

? Fe^{2+} ions in 1 molecule

★ lots of ways to solve

$1 \text{ molecule} \times \frac{1 mol}{6.02 \times 10^{23} \text{ molecules}} \times \frac{6.8 \times 10^4 g}{1 mol} = 1.1296 \times 10^{-19} g$ hemoglobin

$1.1296 \times 10^{-19} g (0.0033) = 3.73 \times 10^{-22} g$ Fe^{2+}

$3.7276 \times 10^{-22} g \ Fe^{2+} \times \frac{1 mol}{55.845 g} \times \frac{6.02 \times 10^{23} \text{ ions}}{1 mol} = \boxed{4 \ Fe^{2+} \text{ ions}}$

(37) (a) $C_4H_8 \rightarrow CH_2 \rightarrow \boxed{14.03 g/mol}$

(b) $C_3H_6O_3 \rightarrow CH_2O \rightarrow \boxed{30.03 g/mol}$

(c) $P_4O_{10} \Rightarrow P_2O_5 \rightarrow \boxed{141.94 g/mol}$

(d) $Ga_2(SO_4)_3 \rightarrow Ga_2(SO_4)_3 \rightarrow \boxed{427.64 g/mol}$

(e) $Al_2Br_6 \rightarrow AlBr_3 \rightarrow \boxed{266.692 g/mol}$

(43) (a) 0.039mol Fe / 0.039 = 1 * 3 = 3 $\boxed{Fe_3O_4}$

0.052mol O / 0.037 = 1.33 * 3 = 4

(b) 0.903g P x $\frac{1\ mol}{31.97\ g}$ = 0.0292mol P / 0.0292 = 1 $\boxed{PBr_3}$

6.99g Br x $\frac{1Mol}{79.904g}$ = 0.08748 mol Br / 0.029 = 3

(c) 79.9g C x $\frac{1Mol}{12.01g}$ = 6.65Mol C / 6.65 = 1 $\boxed{CH_3}$

20.1g H x $\frac{1Mol}{1.01g}$ = 19.9 Mol H / 6.65 = 3

(48) 6.16mmol C / 1.23 = 5 $\boxed{C_5H_7N_1}$

8.56 mmol H / 1.23 = 7

1.23 mmol N / 1.23 = 1

(50) mass % of each element

$C_8NO_2H_9$ = 151.18g/mol

%C $\frac{96.08}{151.18}$ x 100 = $\boxed{63.55\%\ C}$

%N $\frac{14.01}{151.18}$ x 100 = $\boxed{9.27\%\ N}$

%O $\frac{32}{151.18}$ x 100 = $\boxed{21.17\%\ O}$

%H $\frac{9.09}{151.18}$ x 100 = $\boxed{6.01\%\ H}$

(51) Methanol (156.3g/mol) C, H, O

0.1595g burned in O_2

$CHO + O_2 \rightarrow CO_2 + H_2O$

0.1595g   0.449g   0.184g

C

$\frac{12.01}{44.01} \times 100 = 27.29\% C$ so $0.449g(0.2729) = 0.1225g$ C

H

$\frac{2.02}{18.02} \times 100 = 11.21\% H$ so $0.184g(0.1121) = 0.0206g$ H

O

0.1595 - 0.1225 - 0.0206 = 0.0164 g O

Calculate Empirical

$0.1225g\ C \times \frac{1\,mol\,C}{12.01g} = 0.0101\,mol\,C / 0.001025 = 10$

$0.0206g\ H \times \frac{1\,mol\,H}{1.01g} = 0.0204\,mol\,H / 0.001025 = 20$

$0.0164g\ O \times \frac{1\,mol}{16.} = 0.001025\,mol\,O / 0.001025 = 1$

$\boxed{C_{10}H_{20}O}$

(57) (a) $Cu(NO_3)_2 + 2KOH \rightarrow Cu(OH)_2 + 2KNO_3$

(b) $BCl_3 + 3H_2O \rightarrow H_3BO_3 + 3HCl$

(c) $CaSiO_3 + 6HF \rightarrow SiF_4 + CaF_2 + 3H_2O$

(d) $(CN)_2 + 4H_2O \rightarrow H_2C_2O_4 + 2NH_3$

(61) (a) $Pb(NO_3)_{2(aq)} + KI_{(aq)} \rightarrow PbI_{2(s)} + KNO_{3(aq)}$

(b) $Si_2Cl_{6(l)} + 4H_2O_{(l)} \rightarrow 2SiO_{2(s)} + 6HCl_{(g)} + H_{2(g)}$

(c) $3NO_{2(g)} + H_2O_{(l)} \rightarrow 2HNO_{3(aq)} + NO_{(g)}$

☆ (62) NEW

$\cancel{2Cl} + 2O_3 \rightarrow \cancel{2ClO} + 2O_2$ ☆ Multiply by 2 to eliminate intermediate

$\cancel{2ClO} \rightarrow \cancel{ClOOCl}$

$\cancel{ClOOCl} \rightarrow \cancel{2Cl} + O_2$

$2O_3 \rightarrow 3O_2$

(64) $A_2 + 3B_2 \rightarrow 2AB_3$

3 moles 6 moles

(a) B_2 is limiting

(b) 4 molecules of AB_3 can be formed

(a) $3 \text{ mol } A_2 \times \frac{2 \text{ mol } AB_3}{1 \text{ mol } A_2} = 6 \text{ mol } AB_3$

$6 \text{ moles } B_2 \times \frac{2 \text{ mol } AB_3}{3 \text{ mol } B_2} = 4 \text{ mol } AB_3$

(69) $Bi_2O_3 + 3C \rightarrow 2Bi + 3CO$

283g ?mole

?mol

(a) $283g \times \frac{1\,mol}{465.96g} = \boxed{0.607\,mol\ Bi_2O_3}$

(b) $0.607\,mol\ Bi_2O_3 \times \frac{2\,mol\ Bi}{1\,mol\ Bi_2O_3} = \boxed{1.21\,mol\ Bi}$

(71) $Cr_2O_3 + 3H_2S \rightarrow Cr_2S_3 + 3H_2O$

?mol 421g

?g

(a) $421g\ Cr_2S_3 \times \frac{1\ mol\ Cr_2S_3}{200.1872g} \times \frac{1\,mol\ Cr_2O_3}{1\,mol\ Cr_2S_3} = 2.103\,mol\ Cr_2O_3$

(b) $2.103\,mol\ Cr_2O_3 \times \frac{151.99g\ Cr_2O_3}{1\,mol\ Cr_2O_3} = 319.64g\ \boxed{320g}$

LIMITING

(79) $SrH_2 + 2H_2O \rightarrow Sr(OH)_2 + 2H_2$

5.70g 4.75g ?g

$5.70g\ SrH_2 \times \frac{1\ mol\ SrH_2}{89.636g} \times \frac{2\,mol\ H_2}{1\,mol\ SrH_2} = 0.127\,mol\ H_2$

$4.75g\ H_2O \times \frac{1\,mol\ H_2O}{18.02g} \times \frac{2\,mol\ H_2}{2\,mol\ H_2O} = 0.264\,mol\ H_2$

SrH_2 is limiting so...

$0.127\,mol\ H_2 \times \frac{2.016g}{1\,mol} = \boxed{0.256g\ H_2}$

(81) $Al_2S_3 + 6H_2O \rightarrow 2Al(OH)_3 + 3H_2S$

158g 131g ?mol ?g

?g excess

$$158g\,Al_2S_3 \times \frac{1\ mol}{150.155\,g} \times \frac{3mol\,H_2S}{1mol\,Al_2S_3} = 3.16\ mol\ H_2S$$

$$131g\,H_2O \times \frac{1mol\,H_2O}{18.02g} \times \frac{3\ mol\ H_2S}{6mol\,H_2O} = 9.01\ mol\ H_2O$$

Al_2S_3 is limiting

$$\boxed{3.16mol\ H_2S}$$

$$3.16mol\ H_2S \times \frac{34.081\,g\,H_2S}{1mol\ H_2S} = \boxed{107.7g\ H_2S}$$

Calculating Excess

$$158g\,Al_2S_3 \times \frac{1mol\ Al_2S_3}{150.155gAl_2S_3} \times \frac{6mol\ H_2O}{1mol\ Al_2S_3} \times \frac{18.02gH_2O}{1mol\,H_2O} = 113.71g\ H_2O\ \text{used}$$

$$131g - 113.71g = \boxed{17.29g\ H_2O\ excess}$$

(89) percent yield ?

$$PCl_3 + 3H_2O \rightarrow 3HCl + H_3PO_3$$

200g (under PCl_3)

128g actually made in lab (under $3HCl$)

$$200g \times \frac{1 mol\ PCl_3}{137.32g} \times \frac{3 mol\ HCl}{1 mol\ PCl_3} \times \frac{36.458g}{1 mol\ HCl} = 159.3g$$

↓ theoretical yield → perfect lab

$$\%\ yield = \frac{act}{theo} \times 100$$

$$= \frac{128}{159.3} \times 100 = 80.35\%\ yield$$

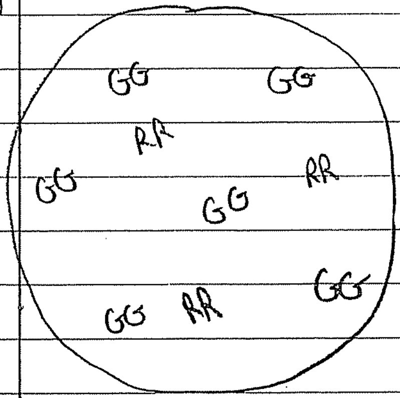
(93) green - chlorine red - oxygen

(a) Ⓐ represents product of decomposition

(b) $2Cl_2O \rightarrow 2Cl_2 + O_2$

0.3mol

(c)



each R = 0.050mol(6) = 0.3mol O atoms

$$0.3 mol\ O atoms \times \frac{1 Mol\ O_2 molecules}{2 mol\ O atoms} \times \frac{2 mol\ ClO_2}{1 mol\ O_2} \times \frac{6.02 \times 1}{1 Mol}$$

$$\boxed{= 1.81 \times 10^{23} molecules\ Cl_2O}$$

(102) Serotonin $(MM = 176 g/mol)$

$68.2\%\ C \times \frac{1 Mol}{12.01g} = 5.678 mol / 0.5675 = 10$

$6.86\%\ H \times \frac{1 Mol}{1.008g} = 6.81 Mol / 0.5675 = 12$

$15.9\%\ N \times \frac{1 Mol}{14.01g} = 1.135 Mol / 0.5675 = 2$

$9.08\%\ O \times \frac{1 Mol}{16g} = 0.5675 Mol / 0.5675 = 1$

empirical formula $C_{10}H_{12}N_2O$

empirical mass 176.216g/mol

So molecular formula is $C_{10}H_{12}N_2O$

$\frac{\text{Molecular mass}}{\text{emp. mass}} = 1$

(105) $CH + O_2 \rightarrow CO_2 + H_2O$

0.847g 2.657g 1.089g

Carbon

$$\frac{12.01}{44.01} = 0.2729(2.657) = 0.725\ g\ C$$

hydrogen

$$\frac{2.016}{18.016} = 0.1119(1.089) = 0.122\ g\ H$$

$$0.725g\ C \times \frac{1mol\ C}{12.01g} = 0.0604\ mol\ C / 0.0604 = 1$$

$$0.122g\ H \times \frac{1mol\ H}{1.016g} = 0.12\ mol\ H / 0.0604 = 2$$

$$\boxed{\text{empirical formula } CH_2}$$

(107) $C_7H_8 + 9O_2 \rightarrow 7CO_2 + 4H_2O$

? molecules

20mL ?g

total moles?

$d = 0.867 g/mL$

$$20mL \times \frac{.867g}{1mL}$$

$$17.34g\ C_7H_8 \times \frac{1\ mol\ C_7H_8}{92.134\ g} \times \frac{9\ mol\ O_2}{1\ mol\ C_7H_8} \times \frac{32g}{1\ mol\ O_2} = \boxed{54.20g\ O_2}$$

$$17.34g\ C_7H_8 \times \frac{1mol\ C_7H_8}{92.134g} \times \frac{7mol\ CO_2}{1mol\ C_7H_8} = 1.32 mol\ CO_2$$

$$\boxed{2.07 mol \text{ of gas}}$$

$$17.34g\ C_7H_8 \times \frac{1mol\ C_7H_8}{92.134g} \times \frac{4\ H_2O}{1\ mol\ C_7H_8} = 0.753\ mol\ H_2O \times \frac{6.02 \times 10^{23}}{1mol} =$$

$$\boxed{4.53 \times 10^{23} \text{ Molecule}}$$

(114) ⓐ False Same # of units as another substance

ⓑ true

ⓒ False when both reactant quantities are given

ⓓ False are sometimes different