Chem 8 / week 11-13-18

chem 8

① Calcium hydride, CaH_2, reacts with water to produce calcium hydroxide and hydrogen. 8.5g of hydrogen is produced.

a) balanced equation

b) Calc mass CaH_2 used in rxn.

② How many grams of NaN_3 are required to form 10g nitrogen:

$2NaN_3 \rightarrow 2Na + 3N_2$

③ 10g octane reacts with oxygen to produce H_2O and CO_2. (a) balanced equation (b) Calc mass oxygen used. (c) Calc mass CO_2 produced. (d) Actual yield is 27.8g CO_2. Calc % yield.

④ Calc % mass of designated atom:

$(NH_4)_2SO_4$

↑

CO_2

↑

⑤ Calc the # of O atoms in 0.00488 moles $Al(NO_3)_3$.

⑥ During a chemical analysis it was found that 15.86g valium contained 0.05570 moles. Calc Mm.

⑦ Determine shape [redacted]: Must draw LF

$SiCl_4$, SO_2, PCl_3, XeO_3, BeI_2, BH_4^-, BF_3, CS_2, O_3

⑧ Select the pair of atoms closest in IE.

Zr, Ru, Ag, Te, Cd

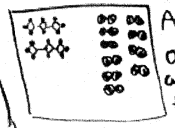
⑨ The coefficient that should precede SO_3 is ____.

$\_S_8 + \_O_2 \rightarrow \_SO_3$

⑩ Given:

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

The following molecules are combined:



A rxn occurs and goes to 100%

Draw the box that represents the product shapes.

⑪ which substance exhibits ionic bonding:

H_2O_2, CO, SiO_2, Na_2O

⑫ The complete combustion of C_4H_{10} produces ____ and ____.

⑬ A compound contains 0.004789g H and 0.04281g C. The Mm is between 115 and 125. Find EF and MF.

⑭ Given:

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

If the % yield is 67.5% and the actual yield of CO_2 is 2.7g, calc the mass C_3H_8 used to produce the CO_2.

⑮ 2.1g of propane combusts in air.

a) balanced equation

b) Calc Theo yield in mass of CO_2.

c) Calc mass oxygen used.

d) If actual yield is 5.37g CO_2, Calc % yield.

⑯ Given:

$CS_2 + 3Cl_2 \rightarrow CCl_4 + S_2Cl_2$

Calc grams CS_2 needed to react with 62.7g chlorine.

⑰ A 0.008Mg sample of penicillin was decomposed so all the S in the sample was converted to $BaSO_4$. 0.0054g $BaSO_4$ was produced. Calc % mass of S in Penicillin.

⑱ 4.2mole zinc sulfide reacts with 6.8mole oxygen to form zinc oxide and sulfur dioxide.

a) balanced equation

b) Find L.R

c) Calc mass zinc oxide

d) Calc mass remaining reactant.

⑲ 10g bromine reacts with 10g sodium iodide to produce sodium bromide and iodine.

a) balanced equation

b) Find L.R

c) Calc theo yield in mass sodium bromide.

d) Calc mass remaining reactant.

8.5g hydrogen is formed along with calcium hydroxide when calcium hydride, CaH_2, reacts with water.

a. balanced equation

b. Calc mass calcium hydride.

$$CaH_2 + 2H_2O \rightarrow Ca(OH)_2 + 2H_2$$

$$8.5g\ H_2 \times \frac{1\text{mole}}{2.016g} \times \frac{1\ CaH_2}{2\ H_2} \times \frac{42.1g\ CaH_2}{\text{mole}} =$$

$$= 88.75g\ CaH_2$$

2

How many grams of NaN_3 are required to form 10g nitrogen by:

$$2NaN_3 \rightarrow 2Na + 3N_2$$

$$10g\ N_2 \times \frac{1\text{mole}}{28.0g} \times \frac{2NaN_3}{3N_2} \times \frac{65.0g\ NaN_3}{1\text{mol}} = 15.5g\ NaN_3$$

3

10g octane reacts with oxygen to form carbon dioxide and water.

a. balanced equation $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$

b. Calc mass O_2 used

c. Calc mass CO_2

Actual yield is 27.6g CO_2. Calc % yield: 90.3%

$$10g\ C_8H_{18} \times \frac{1\text{mol}}{114.2g} \times \frac{25O_2}{2C_8H_{18}} \times \frac{32g\ O_2}{\text{mole}} = 35g\ O_2$$

$$0.08756\text{mole}\ C_8H_{18} \times \frac{16CO_2}{2C_8H_{18}} = 0.7005\text{mole}\ CO_2 \times \frac{44g}{\text{mole}} = 30.8g\ CO_2$$

Calc % mass element indicated by arrow

$(NH_4)_2SO_4$ (132) 6.1%

$C_{18}H_{24}O_2$ (272) 11.8%

$C_{18}H_{27}NO_3$ (305) 70.8%

CO_2 (44) 27.3%

$CS(NH_2)_2$ (76.1) 15.8%

Calc mass

5.76×10^{-3} mole CdS (144.48)

0.832 g

Calc moles

112.6 g NH_4Cl (53.49)

2.11 mole

Calc molecules

1.305×10^{-2} mole C_6H_6

$\times N_A = 7.8 \times 10^{21}$ molec

Calc mol O atoms

4.88×10^{-3} mole $Al(NO_3)_3$

$\times \frac{9 \text{ mol O}}{1 \text{ mol } Al(NO_3)_3} \times N_A$

$= 2.64 \times 10^{22}$ O atoms

Given 0.2142 mole SO_4^{-2},

Calc mass $Fe_2(SO_4)_3$ (400).

$0.2142 \text{ mole } SO_4^{-2} \times \frac{1 \text{ } Fe_2(SO_4)_3}{3 \text{ } SO_4^{-2}} =$

$= 0.0714 \text{ mole } Fe_2(SO_4)_3 \times \frac{400 \text{ g}}{\text{mole}}$

$= 28.56 \text{ g } Fe_2(SO_4)_3$

Calc mol NH_4^+ in 8.776 g $(NH_4)_2CO_3$ (96.1).

$8.776 \text{ g } (NH_4)_2CO_3 \times \frac{}{96.1} = 0.0913 \text{ mole}$

$\times \frac{2 NH_4^+}{1 (NH_4)_2CO_3} = 0.1826 \text{ mole } NH_4^+$

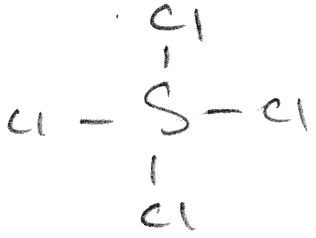
During a chemical analysis it was determined that 15.86 g valium is 0.05570 moles, Calc Mm. 284.7

Calc mass aspirin, $C_9H_8O_4$ (180)

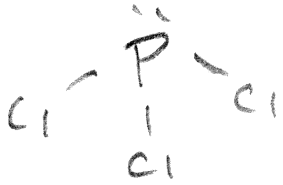
$6.52 \times 10^{21} \text{ molecules} \times \frac{1}{N_A} \times Mm$

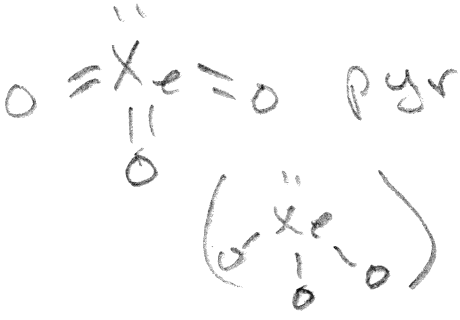
$= 1.95 \text{ g } C_9H_8O_4$

7 Determine shape and polarity.

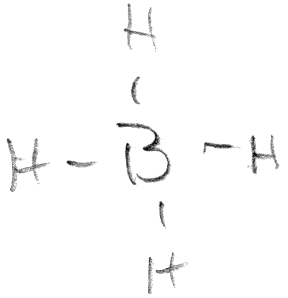
$SiCl_4$  tet, non

SO_2  bent, polar

PCl_3  pyrm., polar

XeO_3  pyrm, polar

BeI_2 $I-Be-I$ linear, non

BH_4^-  tet, non

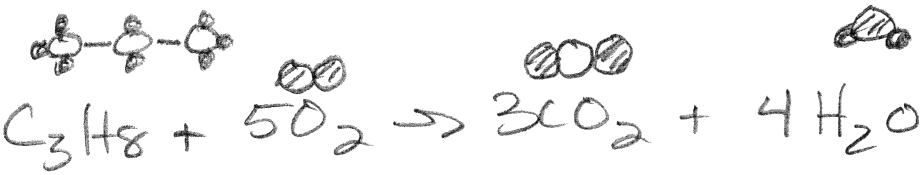
8 Select pair elements that should be closest in IE.

Zr, Ru, (Ag, Cd), Te

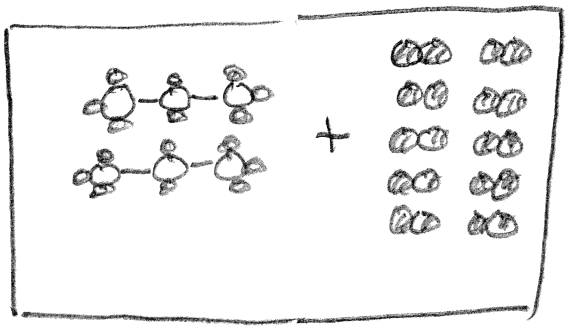
9 The coefficient that should be in front of the SO_3 is _____.

$$\frac{1}{} S_8 + \frac{12}{} O_2 \rightarrow \frac{8}{} SO_3$$

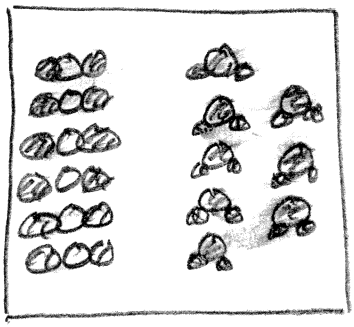
10



$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$



Draw box that reps $CO_2 + H_2O$ formed



(3) Which substance exhibits ionic bonding?

H_2O_2

CO

SiO_2

Na_2O

(2) The complete combustion of C_4H_{10} produces:

$H_2 + CO_2$

$H_2O + O_2$

$HO + CO_2$

$H_2O + CO_2$

(3) What is the molar mass of aluminum hydroxide?

$Al(OH)_3$ $26.98 + 3(17) = 77.98$

(4) Identify the atom with 9 protons, 9 electrons and 10 neutrons.

F^-, O, O^{-2}, F, Ne

Cumene is composed of only C, H. 47.6 mg Cumene is combusted producing CO_2 and 42.8 mg H_2O. Molar mass is between 115 & 125. Determine EF & Molecular Formula

$$\text{unk} + O_2 \rightarrow CO_2 + H_2O$$

0.0476 g ? 0.0428 g

C, H

0.0476 g − H = g C

$$0.0428\,g\,H_2O \times \frac{0.1119005}{} = 0.004789343\,g\,H \times \frac{}{1.008} = 0.0047513\,\text{mol H}$$

(3) 1.3329387 = 3.99

$$0.04281\,g\,C = 0.04281\,g\,C \times \frac{}{12.01} = 0.00356453$$

1 (3)

$$EF = C_3H_4$$

3 3 3

$$M_m MF = 120$$

$$M_m EF = 40.062 = 3$$

$$MF = C_9H_{12}$$

$$O_2 + 2H_2 \rightarrow 2H_2O$$

10 g 10 g

lim

$$0.3125\,\text{mole}\,O_2 \times \frac{2H_2O}{1O_2} = 0.625\,\text{mole}\,H_2O \times \frac{18\,g}{\text{mole}} = 11.25\,g\,H_2O$$

$$5\,\text{mole}\,H_2 \times \frac{2H_2O}{2H_2} = 5\,\text{mole}\,H_2O$$

1.26 g used

$$0.3125\,\text{mole}\,O_2 \times \frac{2H_2}{1O_2} = 0.625\,\text{mol}\,H_2$$

mass remaining 8.75 g

$$5 - 0.625\,\text{mole} = 4.375\,\text{mole}\,H_2 \times 2g =$$

[redacted]

14

act = 2.7g

4g → 0.0909 mole CO_2 × $\frac{1\ C_3H_8}{3CO_2}$ = 0.0303 mol C_3H_8 × 44 = 1.33g C_3H_8

Given $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

If the % yield is 67.5% and the actual yield of CO_2 is 2.7g, calc the mass C_3H_8 used to produce the CO_2.

$$0.675 = \frac{2.7g}{X} \Rightarrow 4g\ CO_2 \times \frac{1}{44}$$

$$= 0.0909 \text{ mole} \times \frac{1\ C_3H_8}{3CO_2} =$$

$$= 0.0303 \text{ mol } C_3H_8 \times 44 = 1.33g\ C_3H_8$$

[redacted]

1 mole Al reacts with 2 mole Cl_2. The LR is _____. Show calc!

$2Al + 3Cl_2 \rightarrow 2AlCl_3$

LR

$$1 \text{ mole Al} \times \frac{2AlCl_3}{2Al} = 1 \text{ mole } AlCl_3 \rightarrow 133g$$

$$2 \text{ mole } Cl_2 \times \frac{2AlCl_3}{3Cl_2} = 1.333 \text{ mole } AlCl_3$$

a. Calc theo yield in mass of CO_2; 2.1g C_3H_8

b. Calc mass of O_2 reacted

c. % yield

$$\underset{44.094}{C_3H_8} + \underline{5}\,\overset{32}{O_2} \rightarrow \underline{3}\,\underset{44.01}{CO_2} + \underline{4}\,H_2O$$

2.1g ↓

(a) $2.1\text{g}\,C_3H_8 \times \frac{1\text{ mole}}{44.094\text{g}\,C_3H_8} = 0.047625\text{ mole}\,C_3H_8 \times \frac{3\,CO_2}{1\,C_3H_8} =$

$= 0.1428765\text{g}\,CO_2 \times \frac{44.01\text{g}}{CO_2} =$ **6.2879g CO_2** (Theo yield)

$$\%\text{ yield} = \frac{\text{actual yield}}{\text{Theo}} \times 100$$

actual yield = The amount in g's of product actually obtained in the experiment. Value is given or obtained by calc using formula.

(b) $\frac{0.047625\text{ mole}\,C_3H_8}{1} \times \frac{5\,O_2}{1\,C_3H_8} = 0.238125\text{ moles}\,O_2 \times 32 =$ **7.62g O_2**

(c) If actual is 5.32g CO_2:

$\% = \frac{5.32}{\text{theo}} \times 100 =$ **84.6%**

Given: $CS_2 + 3Cl_2 \rightarrow CCl_4 + S_2Cl_2$

16 Calc grams CS_2 needed to react with 62.7g of chlorine.

$$62.7\,g\,Cl_2 \times \frac{1\,mol\,Cl_2}{70.90\,g\,Cl_2} \times \frac{1\,CS_2}{3\,Cl_2} \times \frac{76.15\,g\,CS_2}{1\,mole} =$$

$$= 22.4\,g\,CS_2$$

17 Penicillin V was treated chemically to convert the sulfur in the compound into $BaSO_4$. A 0.00819g sample Penicillin V gave 0.00546g $BaSO_4$. what is the % mass of S in Penicillin V.

$$0.00546\,g\,BaSO_4 \times \frac{1\,mol}{233.4\,g} \times \frac{1\,mol\,S}{1\,BaSO_4} \times \frac{32.06\,g}{mole} =$$

$$= 0.7502 \times 10^{-4}\,g\,S = 0.0007502\,g\,S$$

$$\text{mass \%} = \frac{0.0007502}{0.00819\,g} \times 100 = 9.16\%$$

#18

4.2 mole zinc sulfide reacts with 6.8 mol oxygen to form zinc oxide and sulfur dioxide.

a) bal eq

b) L.R

c) calc mass zinc oxide

d) calc mass reactant remaining

$$2\,ZnS + 3\,O_2 \rightarrow 2\,ZnO + 2\,SO_2$$

L.R

$4.2\text{ mole } ZnS \times \frac{2\,ZnO}{2\,ZnS} = 4.2\text{ mole } ZnO \times \frac{81.39\text{ g}}{\text{mole}} = 341.8\text{ g } ZnO$

$6.8\text{ mole } O_2 \times \frac{2\,ZnO}{3\,O_2} = 4.53\text{ mole } ZnO$

$4.2\text{ mole } ZnS \times \frac{3\,O_2}{2\,ZnS} = 6.3\text{ mole } O_2 \times \frac{32\text{ g } O_2}{\text{mole}} = 201.6\text{ g } O_2 \text{ used up}$

Mass excess $O_2 \Rightarrow 6.8\text{ mole } O_2 \times \frac{32\text{ g}}{\text{mole}} = 217.6\text{ g } O_2$ excess

$217.6\text{ g } O_2$ excess $- 201.6\text{ g } O_2$ used up $= 16\text{ g } O_2$ remains

19 $10\,g\,Br_2$ reacts $\bar{c}$ $10\,g\,NaI$ to produce

$NaBr$ and I_2.

$2(79.9) = 159.8$ $\quad 22.99 + 126.90 = 149.89$ $\quad 22.99 + 79.9 = 102.89$

$$Br_2 + 2NaI \rightarrow I_2 + 2NaBr$$

$10\,g$ $\quad 10\,g$

$$10\,g\,Br_2 \times \frac{}{159.8} = 0.062578\,mole\,Br_2 \times \frac{2\,NaBr}{1\,Br_2} = 0.125156\,mole\,NaBr$$

$$10\,g\,NaI \times \frac{}{149.89} = 0.066716\,mole\,NaI \times \frac{2\,NaBr}{2\,NaI} = 0.066716\,mole\,NaBr \times 102.89 =$$

(10 g NaI is the LR)

$= 6.86\,g\,NaBr$

$$0.066716\,mole\,NaI \times \frac{1\,Br_2}{2\,NaI} =$$

$$= 0.033358\,mole\,Br_2\ used \times \frac{159.8\,g}{mole} =$$

$= 5.33\,g\,Br_2$ used

Mass Remaining Br_2?

$10\,g - 5.33\,g = 4.67\,g\,Br_2$ Remains

($10\,g$ excess; $5.33\,g$ used)