12

Chem A

~~3-8-18~~

5-9-18

1-23-18

(1) 1.5 mole O_2 is combined with 0.666 mole KCl by:
$3O_2 + 2KCl \rightarrow 2KClO_3$
Find the LR and calc theo yield in moles $KClO_3$.

(2) 1.25 mole P is combined with 1.5625 mole O_2 to produce diphosphorous pentoxide.
a) bal. equation
b) Find L.R.
c) Calc theo yield in moles of the product.

(3) 0.98 mole $FeCl_3$ reacts with 2.97 mole NaOH by:
$FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$
Find L.R.
Calc mole $Fe(OH)_3$

(4) Calc % mass N in NH_4NO_3.

(5) Calc the moles in 59.1g $CHCl_3$.

(6) Given $N_2 + 3H_2 \rightarrow 2NH_3$
0.2 mole N_2 is combined with 0.3 mole H_2. Find the LR and calc the moles NH_3.

(7) Given:
$C_7H_{16} + 11O_2 \rightarrow 7CO_2 + 8H_2O$
write the ratio that shows the formation of CO_2 from O_2.

(8) Given: $O_2 + 2H_2 \rightarrow 2H_2O$
If 3 mole O_2 is available, calc moles H_2 needed for the rxn.

(9) Given:
$4Al + 3O_2 \rightarrow 2Al_2O_3$
1g Al is combined with 1g O_2. Calc the theo yield in mass of Al_2O_3.

(10) 1g Al is combined with ~~1g~~ 7.5g HCl by:
$2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$
a) Find LR
b) Calc theo yield in mass of $AlCl_3$.
c) Find mass used of other reactant.

(11) 0.8g HF is used to initiate a rxn with $Na_2Si_2O_3$ by:
$Na_2Si_2O_3 + 8HF \rightarrow H_2Si_2F_6 + 2NaF + 3H_2O$
a) Calc mass $Na_2Si_2O_3$ used.
b) Calc mass NaF produced.

(12) 7.50g C_2H_5OH are formed by:
$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$
Calc the mass $C_6H_{12}O_6$ used to make the C_2H_5OH.

(13) 0.5g $Al(OH)_3$ reacts with HCl to produce $AlCl_3$ and H_2O.
a) balanced equation
b) Calc theo yield in mass of $AlCl_3$.
c) Calc mass HCl used in rxn.

(14) 0.5 mole H_2 is combined with 0.25 mole O_2 by:
$2H_2 + O_2 \rightarrow 2H_2O$
a) Find L.R.
b) Calc moles H_2O produced.

(15) Calc Mm
$Pb(C_2H_3O_2)_2$

(16) Select the compound that is 47.8% C.
CO_2, C_3O_4, C_2O_2, C_4O_2

(17) Calc the mass of MSG ($NaC_5H_8O_4N$) produced if 238g of Na was used to produce it. Assume other elements are in excess.

(18) Count the total atoms in $CuSO_4 \cdot 11H_2O$

(19) Ibuprofen is 75.69% C, 8.8% H, 5.51% O, and the MM is 206. Find EF and MF.

(20) Given:
$Al_2S_3 + 6H_2O \rightarrow 2Al(OH)_3 + 3H_2S$
10.5g Al_2S_3 initiates the rxn in an excess of H_2O.
a) Calc theo yield of $Al(OH)_3$.
b) If the actual yield is 7.8g, calc % yield.

(21) 35.4g carbon monoxide is combined with 10.2g hydrogen to produce methanol, CH_3OH.
a) balanced equation
b) L.R.
c) Calc mass CH_3OH.
d) Calc mass of excess reactant used in rxn by L.R.

(22) Given:
$2NO + 5H_2 \rightarrow 2NH_3 + 2H_2O$
0.1 mole H_2 initiates the rxn with an excess of NO.
a) Calc theo yield in mass H_2O.
b) Calc mass NO used.
c) If the actual yield is 0.21g H_2O, calc % yield.

(23) 0.2 mole S^{-2} and 0.3 mole Cl^- are combined in the same solution. Calc moles Pb^{+2} needed to react with all the anion.
Hint: you need 2 equations:
$Pb^{+2} + S^{-2} \rightarrow PbS$
$Pb^{+2} + 2Cl^- \rightarrow PbCl_2$

(24) 1g iron (III) oxide reacts with 1g carbon monoxide to produce iron metal and carbon dioxide.
a) bal equation
b) L.R
c) Calc mass CO_2
d) Calc mass reactant used by L.R.
e) Calc mass remaining reactant

1

$$3O_2 + 2KCl \rightarrow 2KClO_3$$

1.5 mole 0.6666 mole ?

Find LR and calc theo yield $KClO_3$ in moles. Show work.

$$1.5 \text{ mole } O_2 \times \frac{2KClO_3}{3O_2} = 1 \text{ mole } KClO_3$$

$$0.6666 \text{ mole } KCl \times \frac{2KClO_3}{2KCl} = 0.6666 \text{ mole } KClO_3$$

LR Theo yield

2

$$4P + 5O_2 \rightarrow 2P_2O_5$$

1.25 mole 1.5625 mole ?

$$1.25 \text{ P} \times \frac{5O_2}{4P} = 1.5625 \text{ mole } O_2$$

$$1.25 \text{ mole P} \times \frac{2P_2O_5}{4P} = 0.625 \text{ mole } P_2O_5$$

same/same

$$1.5625 \text{ mole } O_2 \times \frac{2P_2O_5}{5O_2} = 0.625 \text{ mole } P_2O_5$$

Theo yield

NO LR

3

$$1FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$$

0.98 mole 2.97 mole ?

$$3 \text{ NaOH} \times \frac{1FeCl_3}{3NaOH} = 1 \text{ mole } FeCl_3$$

$$0.98 \text{ mole } FeCl_3 \times \frac{3NaOH}{1FeCl_3} = 2.94 \text{ mole NaOH}$$

$$\frac{1.05 \text{ mole NaOH}}{3} = 1.05 \text{ mole NaOH}$$

$$0.98 \text{ mole } FeCl_3 \times \frac{Fe(OH)_3}{1FeCl_3} = 0.98 \text{ mole } Fe(OH)_3$$

LR Theo yield

$$2.97 \text{ mole NaOH} \times \frac{Fe(OH)_3}{3NaOH} = 0.99 \text{ mole } Fe(OH)_3$$

6 calc % mass first element in formula

4a. ammonium nitrate, NH_4NO_3 35% N

b $C_8H_{10}N_4O_2$ 194.12 g/mol

$C = 49.47\%\ C$

c $C_6H_{11}OH$ 100.06 g/mol

$C = 71.92\%$

d C_2H_5OH (vodka)

$C = 52.14\%$

15 Calc mass

1.5 mol AlI_3 · 412 g

1.91×10^{-3} mol C_6H_6 0.149 g

4 mol $C_6H_{12}O_6$ 721 g

4.56×10^{5} mol 2.1×10^{7} g C_2H_5OH

2.27 mol $Ca(NO_3)_2$ 373 g

Calc moles

2.62×10^{-6} mol H_2O 1.58×10^{18}

5.27 g C_6H_6 4.03×10^{22}

Calc moles

0.0492 g SO_3 0.000614 mole

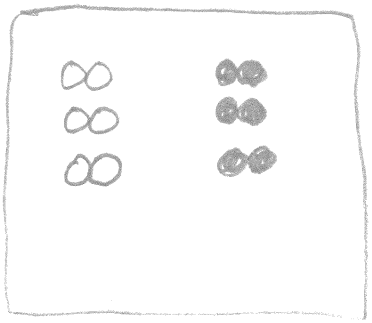
5 59.1 g $CHCl_3$ 0.495 mole $CHCl_3$

4.01 g lithium hydroxide 0.167 mole LiOH

2.01 g Sodium sulfate Na_2SO_4 0.0142 mole Na_2SO_4

(45)

Given $O_2 + 2H_2 \rightarrow 2H_2O$



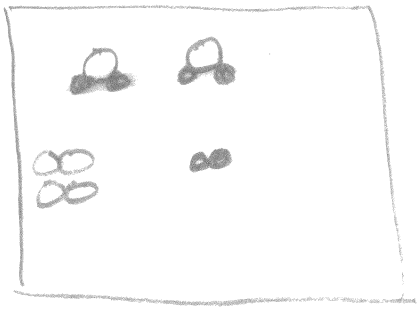
If) Draw the box that represents the rxn mix after rxn is over.

$3O_2 \times \frac{2H_2O}{1O_2} = 6H_2O$

$3H_2 \times \frac{2H_2O}{2H_2} = 3H_2O$

$3H_2 \times \frac{1O_2}{2H_2} = \frac{3}{2}O_2$ needed

$1.5O_2$



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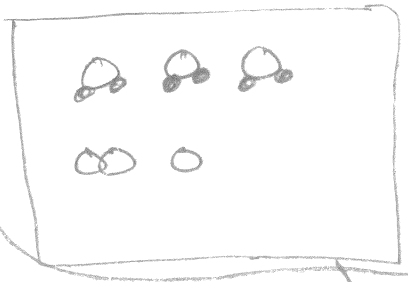

46 Given $N_2 + 3H_2 \rightarrow 2NH_3$

If we have $0.2 mole N_2$ combined with $.3$ mole H_2 identify the L.R

$0.2 mole N_2 \times \frac{2NH_3}{1N_2} = 0.4 mole NH_3$

$0.3 mole H_2 \times \frac{2NH_3}{3H_2} = 0.2 mole NH_3$

L.R

Given the rxn below:

$1\ C_7H_{16} + 11\ O_2 \rightarrow 7\ CO_2 + 8\ H_2O$

7 The mole ratio that best describes the relationship between O_2 and CO_2 is:

$$\frac{7\ CO_2}{11\ O_2}$$

Given $O_2 + 2H_2 \rightarrow 2H_2O$

If you have 3 moles of O_2, how many moles of H_2 are needed for the rxn?

$$3\ mole\ O_2 \times \frac{2H_2}{1O_2} = 6\ mole\ H_2$$

Example

~~57~~ ~~92~~ 9

$$4Al + 3O_2 \rightarrow 2Al_2O_3$$

1g 1g ?

lim

Theo yield

1.889g Al_2O_3

$$1g\ Al \times \frac{1mole}{26.98} = 0.03706049 mole\ Al \times \frac{2Al_2O_3}{4Al} = 0.0185322 mole\ Al_2O_3$$

$$53.96\ Al_2O_3 \quad 101.96$$

$$1g\ O_2 \times \frac{1mole}{32} = 0.03125\ mole\ O_2 \times \frac{2Al_2O_3}{3O_2} = 0.020833 mole\ Al_2O_3$$

10

1g Al reacts with 7.5g HCl to produce aluminum chloride and hydrogen gas.

(a) 1g 7.5g

$$\underline{2}\ Al + \underline{6}\ HCl \rightarrow \underline{2}\ AlCl_3 + \underline{3}\ H_2$$

(b) $1g\ Al \times \frac{1\ mol\ Al}{26.98} = 0.037064\ mol\ Al \times \frac{2\ AlCl_3}{2\ Al} = 0.037064\ mol\ AlCl_3$ (c) $\times 133.33 = 4.94_g\ AlCl_3$

$7.5g\ HCl \times \frac{1\ mol\ HCl}{36.458} = 0.2057\ mol\ HCl \times \frac{2\ AlCl_3}{6\ HCl} = 0.0685\ mole\ HCl$

$0.037064\ mole\ Al \times \frac{6\ HCl}{2\ Al} = 0.1112\ mole\ HCl \times 4.054_g\ HCl$ used

Remaining is: $7.5 - 4.054 = 3.446g$

(d) HCl Remains

(e) write the EC of Al^{+3}

$1s^2 2s^2 2p^6$

(f) From which is it harder to remove an e^-, Cl or Al. Justify with trends. Al is to the left of Cl on the edge of metals. IE increases L → R so Al loses e^- more easily

57 58 9 11

#1 How many grams of Na_2SiO_3 can react with 0.800g HF? Calc mass NaF formed.

$$Na_2SiO_{3(s)} + 8HF \rightarrow H_2SiF_6 + 2NaF + 3H_2O$$

? 0.8g

$$0.8g\ HF \times \frac{1\ mole}{20.01g\ HF} \times \frac{1\ mol\ Na_2SiO_3}{8\ mol\ HF} \times \frac{122.1g\ Na_2SiO_3}{1\ mole} = 0.610g$$

used Na_2SiO_3

$$0.03998\ mole\ HF \times \frac{2\ NaF}{8\ HF} = 0.009995\ mole\ NaF \times \frac{41.99g}{mole} =$$

$= 0.41969g$ NaF
Theo yield

58 12

#4 7.50g C_2H_5OH are formed by:

$$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$$

Calc mass $C_6H_{12}O_6$

$$7.5g\ C_2H_5OH \times \frac{1\ mole}{46.07g} \times \frac{1\ C_6H_{12}O_6}{2\ C_2H_5OH} \times \frac{180.1g}{mole} = 14.7g\ C_6H_{12}O_6$$

59 13

#5 Given: $Al(OH)_3 + HCl \rightarrow AlCl_3 + H_2O$

(a) balance equation: $Al(OH)_3 + 3HCl \rightarrow AlCl_3 + 3H_2O$

(b) [illegible] of 0.5g $Al(OH)_3$ [illegible] reacts.

(c) Calc mass HCl used.

$$0.5g\ Al(OH)_3 \times \frac{1\ mole}{78g} \times \frac{3\ HCl}{Al(OH)_3} \times \frac{36.46g}{mole} = 0.701g\ HCl$$

0.0064 mole $Al(OH)_3$ [illegible]

$= 0.855g\ AlCl_3$

10 Given: 14

$2H_2 + O_2 \rightarrow 2H_2O$

0.5 mole H_2 is combined with 0.25 mole O_2. Find L.R. Calc mole H_2O.

No LR

0.5 mole H_2O

White Board Chem 7

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(1) Molar Mass

zinc carbonate = $ZnCO_3$ 125.4

lead (II) acetate $Pb(C_2H_3O_2)_2$ 325.2

chromium (III) nitrate $Cr(NO_3)_3$ 238.03

nitrogen dioxide NO_2 46.01

carbon tetra chloride CCl_4 153.81

(2) choose the compound that is 60.019 % mass C.

27.289

CO_2 44.01

C_2O_4 100.03

36.819

$C_2O_3^{2-}$

42.877 %

$C_4O_2^{6-}$ 80.04

49.04 60.019 %

16

choose comp that is 42.8% C

C_2O_2

17

Calc. the mass of MSG ($NaC_5H_8O_4N$) produced when 238g of Na is used in the process to produce it.

Na is 13.6% Mm = 169

$$\% = \frac{g(ele)}{g\ comp} \qquad 0.136 = \frac{238g}{X}$$

$$X = \frac{238g}{0.136}$$

$X = 1750g$ MSG

18

the total atoms in $CuSO_4 \cdot 11H_2O$

39

Ibuprofen is 75.69%C, 8.80%H, 15.51%O and the CF Mm = 206g/mole.

Calc. EF 19

$75.69\text{g C} \times \frac{}{12.01} = \frac{6.30\text{mol C}}{0.969} = 6.5\ (2) = 13$

$8.8\text{g H} \times \frac{}{1.008} = \frac{8.73\text{mol H}}{0.969} = 9\ (2) = 18$

$15.51\text{g O} \times \frac{}{16} = \frac{0.969\text{mol O}}{0.969} = 1\ (2) = 2$

EF = CF = $C_{13}H_{18}O_2$

MmEF = MmCF

So EF is CF

Given $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

Calc. grams CO_2 produced when 72g of $C_6H_{12}O_6$ reacts?

35.208g CO_2

Aluminum Sulfide reacts with water to form aluminum hydroxide and hydrogen sulfide.

a. write balanced equation

If act 78g is calc % yield 72%

b. Calc grams aluminum hydroxide from 10.5g Aluminum Sulfide

$1\ Al_2S_3 + 6\ H_2O \rightarrow 2\ Al(OH)_3 + 3\ H_2S$

$10.5\text{g } Al_2S_3 \times \frac{1\text{mol}}{} \times \frac{2\ Al(OH)_3}{1\ Al_2S_3} \times \frac{78\text{g } Al(OH)_3}{} =$ 10.9g $Al(OH)_3$

21

(3) 35.4g of carbon monoxide are combined with 10.2g of hydrogen to produce methanol, CH_3OH.

(a) L.R

(b) Calc mass methanol

(c) Calc remaining reactant

LR

$$CO + 2H_2 \rightarrow CH_3OH$$

$$35.4\,g\,CO \times \frac{1\,mole}{28.01\,g} \times \frac{1\,CH_3OH}{1\,mol\,CO} = 1.263\,mol\,CH_3OH \times 32.04 = 40.5\,g\,CH_3OH$$

$$10.2\,g\,H_2 \times \frac{1\,mole}{2.016\,g} \times \frac{1\,CH_3OH}{2\,H_2} = 2.529\,mol\,CH_3OH$$

H_2 remains

$$1.263\,mol\,CO \times \frac{2\,H_2}{1\,CO} = 2.527\,mol\,H_2 \times 2.016 = 5.0957\,g\,H_2\ used$$

H_2 remains = $10.2\,g\,H_2 - 5.0957 =$

Excess

$= 5.104\,g\,H_2$ remains

How much NO used in mass?

$0.1\text{mole } H_2 \times \frac{2NO}{5H_2} = 0.04\text{mole NO} \times \frac{30g}{\text{mole}} = \underline{1.2g\ NO}$

$\underline{2}NO + \underline{5}H_2 \rightarrow \underline{2}NH_3 + 2H_2O$

excess 0.1mole

Theo yield H_2O in mass

$0.1\text{mole } H_2 \times \frac{2H_2O}{5H_2} = 0.04\text{mole } H_2O \times \frac{18\ g}{\text{mole}} = 0.72g\ H_2O$

actual yield = 0.21g

$\% = \frac{\text{actual yield}}{\text{theo}} \times 100 = \frac{0.21}{0.72g} \times 100 = 29.2\%$

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

excess 1g ? Theo yield CO_2 in mass

$1gO_2 \times \frac{1\text{mole}}{32g} = 0.03125\text{mole}O_2 \times \frac{3CO_2}{5O_2} = 0.01875\text{mole}CO_2 \times \frac{44g}{\text{mole}} =$

$= 0.825g\ CO_2$

Actual yield = 0.64g

mass C_3H_8 used in rxn

$0.03125\text{mole}O_2 \times \frac{1C_3H_8}{5O_2} = 0.00625\text{mole}\ C_3H_8$

$\% = 77.6\%$

$\times \frac{44g}{\text{mole}} = 0.275g\ C_3H_8$ used in rxn.

(7) 0.2 mole of Na_2S is combined with 0.3 mole NaCl in a solution. How much $Pb(NO_3)_2$ is required to ppt all the S^{-2} and Cl^-

$Pb^{+2} + 2Cl^- \rightarrow PbCl_2$

write net ionic ppt rxn:

$Pb^{+2} + S^{-2} \rightarrow PbS$

$0.2\text{ mole } Na_2S = 0.2\text{ mole } S^{-2}$

$0.3\text{ mole NaCl} = 0.3\text{ mole } Cl^-$

$0.2\text{ mole } S^{-2} \times \frac{1\ PbS}{1\ S^{-2}} = 0.2\text{ mole PbS}$

$0.3\text{ mole } Cl^- \times \frac{1\ PbCl_2}{2\ Cl^-} = 0.15\text{ mole } PbCl_2$

Total $Pb(NO_3)_2$ = 0.35 mole

$2M\ Pb(NO_3)_2$

$\frac{0.35\text{ mole}}{2M} = 175\text{ mL}$

(34) 4g of hydrogen sulfide is reacted with 10g iron(III) hydroxide to produce iron(III) sulfide and water.

$3H_2S + 2Fe(OH)_3 \rightarrow Fe_2S_3 + 6H_2O$

4g 10g

$\frac{4\text{g}}{34.076} H_2S = 0.117384666\text{ mole } H_2S \times \frac{Fe_2S_3}{3H_2S} = 0.03912822\text{ mole } Fe_2S_3$

207.88 Fe_2S_3

8.133984 g

$\frac{10\text{g } Fe(OH)_3}{106.874} = 0.09356812\text{ mole } Fe(OH)_3 \times \frac{Fe_2S_3}{2Fe(OH)_3} = 0.04678406$

106.85 8.361g

$0.117384666\text{ mole } H_2S \times \frac{2Fe(OH)_3}{3H_2S} = 0.07825641\text{ mole } Fe(OH)_3$ used

$0.09356812 - 0.07825641 = 0.01531171$ mole $Fe(OH)_3$ remain

1.6364g $Fe(OH)_3$

24 1g (1.8) iron (III) oxide, Fe_2O_3, reacts with carbon monoxide to produce iron metal and carbon dioxide.

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

LR 159.7

$$1g\ Fe_2O_3 \times \frac{}{159.7} = 0.006262\ mole\ Fe_2O_3 \times \frac{3CO_2}{1Fe_2O_3} = 0.018785\ mole\ CO_2$$

Theo yield CO_2

$\times 44 = 0.83_3$

$$1g\ CO \times \frac{}{28} = 0.0357\ mole\ CO \times \frac{3CO_2}{3CO} = 0.0357\ mole\ CO_2$$

$$0.006262\ mole\ Fe_2O_3 \times \frac{3CO}{1Fe_2O_3} = 0.018785\ mole\ CO \times 28g = 0.525298g\ CO$$

used

reacted with Fe_2O_3

mass remaining:

$$1g\ CO - 0.525298g = 0474g\ CO$$

Remains after rxn

1. write bal eq
2. calc L.R
3. Calc Theo yield CO_2
4. Calc mass other reactant used
5. Calc mass remaining react.