1-9-18 WB Chem 8 Pre-comp Review

(1) 35.4g CO is combined with 10.2g H_2 to produce CH_3OH by:

$CO + 2H_2 \rightarrow CH_3OH$

(a) Find LR

(b) Calc theo yield mass CH_3OH

(c) Calc mass H_2 used in the rxn.

(2) Given:

$3O_2 + 2KCl \rightarrow 2KClO_3$

1.5 mole O_2 is combined with 0.6666 mole KC.

Find LR and calc theo yield of $KClO_3$ in MOLES!

(3) Given: $4P + 5O_2 \rightarrow 2P_2O_5$

1.25 mole of P is combined with 1.5625 mole O_2. Find LR and calc theo yield of P_2O_5 in MOLES!

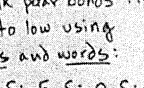
(4) List the 2 ways to separate a heterogeneous mixture.

(5) List the 2 ways to separate a homogeneous mixture.

(6) Which main group is X from? XCl_2

(7) Which main group is X from in XBr_3?

(8) Determine the [redacted] bonding units around C.



(9) If the actual yield is 2.1g and the % yield is 69.2%, calc the theo yield.

(10) Given: $2H_2 + O_2 \rightarrow 2H_2O$

0.5 mole H_2 reacts with 0.25 mole of O_2. Find LR and calc theo yield in moles H_2O.

(11) Given: $Na_2SiO_3 + 8HF \rightarrow H_2SiF_6 + 2NaF + 3H_2O$

Find mass Na_2SiO_3 that reacts with 0.8g HF. Find mass NaF produced.

(12) Given:

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

Calc mass $C_6H_{12}O_6$ if 7.5g of C_2H_5OH was formed in the reaction.

(13) Given the unbalanced equation:

$Al(OH)_3 + \_HCl \rightarrow AlCl_3 + \_H_2O$

(1) balance

(2) Calc mass $AlCl_3$ if 0.5g $Al(OH)_3$ reacts with excess HCl.

(14) Calc % mass of C in $C_8H_{10}N_4O_2$.

(15) Identify the most covalent compound:

$KMnO_4$, HClO, Na_2CO_3, BaO, Li_3PO_4

(16) Name

$Mg(OH)_2$, $Cu(NO_3)_2$, $Zn(C_2H_3O_2)_2$

$BaCO_3$, PbI_2

(17) Why is it easier to remove an e^- from Ca versus Ca^{+2}? Must calculate Zeff for Ca and Ca^{+2}.

(18) LF and shape

BCl_3, ClO_3^-, BrO_2^-, $SiCl_4$

BeI_2

(19) Use arrows and words to rank the ions from small to big: Se^{-2}, S^{-2}, O^{-2}

(20) Select the element or ion with 3 upaired e^- in its highest energy level. Draw OD for each choice.

Cu, Zn^{+2}, Cr^{+3}, Ti^{+2}

(21) Identify the compound with 2 pairs unshared e^- on the central atom:

SeI_2, H_3O^+, BF_3, NH_3, $POCl_3$

(22) Given 2.678g Ba and 3.115g Br. Find EF

(23) A compound contains 6.164 mole C, 8.63 mole H, 1.233 mole N and the Mm is 162.12. Find EF and MF.

(24) Identify the atom with the highest IE.

Sn, Nb, Rh, Zr, Ag

(25) LF

O_2, N_2, H_2, Cl_2, Br_2

I_2, O_3, HCN, CN^-

HCl, $POCl_2^-$

(26) Rank polar bonds from high to low using arrows and words:

Si-B, Si-F, Si-O, Si-N

(27) Formula

copper (I) oxide

aluminum hydroxide

zinc nitrate

iron (II) carbonate

ammonia

(28) A compound contains 40% C, 6.7% H, and 53.3% O. The Mm is 180. Find EF and MF.

(29) Which element has a valence of $3e^-$?

S, Ca, Ga, Sb, Br

(30) Why is N^{-3} larger than N?

(31) Why does Mg ionize more easily than Mg^{+2}?

(32) Why is Ba^{+2} smaller than Ba?

(33) The EF of a compound is CHOCl. The Mm is 129g. Find MF.

(34) Given the unbalanced equation:

$Al + HCl \rightarrow AlCl_3 + H_2$

1g Al reacts with 7.5g HCl.

a) balance eq

b) Find LR

c) Calc theo yield in mass $AlCl_3$

d) Calc mass other reactant USED

(35) Determine # core e^- in O

(36) Determine # core e^- in K

(37) Calc Zeff for valence of N

(38) Write the EC of Al^{+3}

[redacted] 1

(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

$$CO + 2H_2 \rightarrow CH_3OH$$

$$35.4\,g\,CO \times \frac{1\,mole}{28.01\,g} \times \frac{1\,CH_3OH}{1\,mol\,CO} = 1.263\,mol\,CH_3OH \times 32.042 = 40.5\,g\,CH_3OH$$

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

H_2 remains

$$1.263\,mol\,CO \times \frac{2\,H_2}{1\,CO} = 2.527\,mol\,H_2 \times 2.016 = 5.095\,g\,H_2\ used$$

H_2 remains = $10.2\,g\,H_2$ (Excess) $- 5.095 =$

$= 5.104\,g\,H_2$ remains

2

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

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

0.8 1.5625

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

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

1.25 mole 1.5625 mole ?

3

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

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

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

$0.35 \text{ mole } FeCl_3 \times \frac{3 \text{NaOH}}{1 FeCl_3} = 1.05 \text{ mole NaOH}$

4 $1 FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$

0.98 mole 2.97 mole ?

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

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

4 List the 2 ways to separate a heterogeneous mixture: decanting, filtration

5 List the 2 ways to separate a homogeneous mixture (soln):

TLC, Distillation

6 Which Main V group is X from:

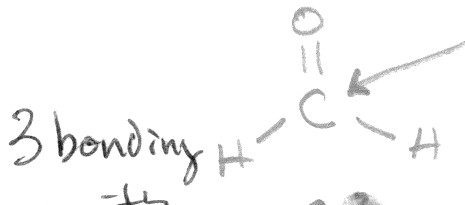
XCl_2

2A

7 Which Main V group is X from: XBr_3

~~3A~~

8 Determine the hybridization of →



~~Sp^2~~

9 Given: $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ (44)

1g Ex

→ If actual is 2.1g and % yield is 69.2%, find Theo yield.

$0.692 = \frac{2.1}{Theo}$ ~~Theo = 3.03g~~

$0.023 \text{ mole } C_3H_8 \times \frac{3CO_2}{1C_3H_8} = 0.069 \text{ mole } CO_2 \times 44 = 3.036g\ CO_2$

Act 2.1g % yield = 69.2%

Given: 10

$2H_2 + O_2 \rightarrow 2H_2O$

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

No L.R

0.5 mole H_2O

11

2. 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

12

3. 7.50 g C_2H_5OH are formed by:

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

Calc mass $C_6H_{12}O_6$

$$7.5g\,C_2H_5OH \times \frac{1\,mole}{46.07g} \times \frac{1\,C_6H_{12}O_6}{2\,C_2H_5OH} \times \frac{180.?g}{mole} = 14.7g\,C_6H_{12}O_6$$

13

3. Given: $Al(OH)_3 + HCl \rightarrow AlCl_3 + H_2O$

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

(b) Calc mass $AlCl_3$ if 0.5g $Al(OH)_3$ reacts.

(c) Calc mass HCl used.

$$0.5g\,Al(OH)_3 \times \frac{1\,mole}{78g} \times \frac{AlCl_3}{Al(OH)_3} \times \frac{133.34g}{mole} = 0.855g\,AlCl_3$$

$$\frac{3HCl}{36.46g} = 0.701g\,HCl \leftarrow \text{mass used}$$

Calc % mass first element in formula

(a) ammonium nitrate, NH_4NO_3 35% N

80

194.12

(b) $C_8H_{10}N_4O_2$

14

$C = 49.47\%\ C$

100.06

(c) $C_6H_{11}OH$

$C = 71.92\%$

(d) C_2H_5OH (46)

$C = 52.14\%$

Calc mass

1.5 mol AlI_3 · 612 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 molecules

2.62×10^{-6} mol H_2O 1.58×10^{18}

5.23 g C_6H_6 4.03×10^{22}

Calc moles

0.0492 g SO_3 0.000614 mole

80

59.1 g $CHCl_3$ 0.495 mole $CHCl_3$

119.4

4.01 g lithium hydroxide 0.167 mole LiOH

24

142

2.01 g Sodium sulfate Na_2SO_4 0.0142 mole Na_2SO_4

142

~~10~~ Covalent or Ionic

HBr C

$CaCl_2$ I

CH_4 C

$KMnO_4$ I

H_2SO_4 C

KCN I

C_2H_4 C

~~15~~ 15

Identify the most covalent compound:

$KMnO_4$ HClO Na_2CO_3 BaO Li_3PO_4

Name

$NaOH$	Sodium hydroxide
$Mg(OH)_2$	magnesium hydroxide
$Cu(NO_3)_2$	copper (II) nitrate
$Zn(C_2H_3O_2)_2$	Zinc acetate
$BaCO_3$	Barium carbonate
$SrCl_2$	Strontium chloride
$AgCl$	Silver chloride
PbI_2	lead (II) iodide

Formula

lead (II) chromate	$PbCrO_4$
iron (II) sulfate heptahydrate	$FeSO_4 \cdot 7H_2O$
copper (II) oxide	CuO
Sodium chloride	$NaCl$
potassium carbonate	K_2CO_3
ammonium chloride	NH_4Cl

16 Use Zeff to explain why Mg^{+3} does not form.

Mg^{+2} $1s^2|2s^2 2p^6$

$Zeff = 12 - 2 = +10$ on

Nuclear charge is ↑, so Mg^{+3} does not form.

18 Write the OD for Ca^{+2} ... 4↑ 4↑ 1 1 1 (3d)

19 Valence EC of Sn: $...5s^2 5p^2$

20 Valence EC of S^{-2} $...3s^2 3p^6$

17 Why is it easier to remove an e^- from Ca than Ca^{+2}?

$1s^2 2s^2 2p^6|3s^2 3p^6$

$Zeff = 20 - 10 = +10$

Ca Zeff = +2

Ca^{+2} ~~Zeff~~ = +10

Draw the LF, Hyb, Shape:

18

BCl_3 H_2S $AlCl_4^-$

ClO_3^- XeO_4 IBr_2^+

BrO_2^- AsO_3^{-3} $SOCl_2$

NO^+

$SiCl_4$ CS_2 H_3O^+

BeI_2 HCN

19

Use arrows and words to rank the size of Se^{-2}, O^{-2}, S^{-2}

$O^{-2} < S^{-2} < Se^{-2}$

small large

Select the element or ion with 3 unpaired e^- in its highest energy level:

20 Cu, Zn^{+2}, Cr^{+3}, Ti^{+2}

Cr^{+3} $\underline{1}\ \underline{1}\ \underline{1}\ \_\ \_$

3d

Identify the compound with 2 pairs unshared e^- on central atom.

21 SeI_2 H_3O^+ BF_3 NH_3 $POCl_3$

~~22~~ given moles

Given 0.01950 mole (2.678g) of Ba and 0.03899 mole Br (3.115g)

find EF

22

$\frac{0.01950 \text{ mole Ba}}{0.01950} = 1 \text{ Ba}$

$\frac{0.03899 \text{ mole Br}}{0.01950} = 1.999 \text{ Br}$

$BaBr_2 = EF$

~~20~~

$M_m = 162.12$

~~11~~

$74.02 \text{ g C} \times \frac{1 \text{ mole}}{12.01} = \frac{6.164 \text{ mol C}}{1.233\ldots} = 4.999 = 5 \text{ C}$

$8.70 \text{ g H} \times \frac{1 \text{ mole}}{1.008} = \frac{8.63 \text{ mol H}}{1.233\ldots} = 6.999 = 7 \text{ H}$

23 $17.27 \text{ g N} \times \frac{1 \text{ mole}}{14.01} = \frac{1.233 \text{ mole N}}{1.233\ldots} = 1 \text{ N}$

$\frac{162.12}{81.116} = 1.998 = 2$

$C_5H_7N = EF$

$2(C_5H_7N) = C_{10}H_{14}N_2$

60.05 7.056 + 14.01

$5(12.01) + 7(1.008) + 14.01 =$

$= 81.116$

C	H	N
12.01	1.008	14.01

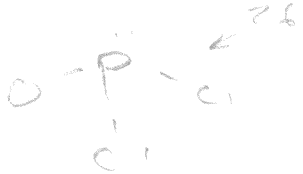
Identify the element with highest IE

24 (Sn), Nb, Rh, Zr, Ag

Sketch the LF

O_2	HCN
N_2	HCl
Cl_2	$POCl_2^-$
I_2	
Br_2	
O_3	

25



Given K^+, Cl^-, S^{-2}; calc Zeff for each ions valence. THEN use words and arrows to rank the size.

K^+ $1s^2 2s^2 2p^6 | 3s^2 3p^6$

$Zeff = 19 - 10 = +9$

Cl^- $1s^2 2s^2 2p^6 | 3s^2 3p^6$

$Zeff = 17 - 10 = +7$

S^{-2} $1s^2 2s^2 2p^6 | 3s^2 3p^6$

$Zeff = 16 - 10 = +6$

Smallest ... biggest

$K^+ < Cl^- < S^{-2}$

$+9 \quad +7 \quad +6$

26 Rank polar bonds from high to low using arrows and words.

Si-B, Si-F, Si-O, Si-N

Si-F > Si-O > Si-N > Si-B

(4) formula

copper (I) oxide Cu_2O

potassium peroxide K_2O_2

aluminum hydroxide $Al(OH)_3$

zinc nitrate $Zn(NO_3)_2$

iron (II) carbonate $FeCO_3$

iron (III) $Fe_2(CO_3)_3$

ammonia NH_3

ammonium NH_4^+

(5) find EF

a) 0.0130 mol C, 0.0390 mol H, 0.0065 mol O

C_2H_6O 46.068 $C_4H_{12}O_2$ 92.136

11.66 g iron, 5.0 g O

$11.66\text{ g Fe} \times \frac{}{55.85} = 0.2087735\text{ mole Fe} = 1\ (2)$

$5.0\text{ g O} \times \frac{}{16.00} = 0.31312\text{5 mole O} = 1.499831157\ (2)$

$= 3$

Fe_2O_3

40% C, 6.7% H, 53.3% O

CH_2O $M_m = 180$

$C_6H_{12}O_6$

29

Which element has a valence of $3e^-$?

S, Ca, Ga, Sb, Br

30

Why is N^{-3} larger than N?

e^- repulsion

31

Why is the ionization of Mg^{+2} greater than Mg?

Mg^{+2} has higher ~~Zeff~~

32

Why is Ba^{+2} smaller than Ba?

Ba^{+2} is in an lower n level

increased Zeff

3. continued - % composition

Calculate % composition all elements in $Cu(IO_4)_2$ 24.1, 27, 48

Calculate % composition all elements in $(NH_4)_2C_2O_4$ 22.6, 6.52, 19.4,

4. Empirical Formula

a. Calculate empirical formula of a compound that contains 1.67g Ce and 4.54g I. CeI_3

b. Calculate EF for a compound that is 68.8% C, 4.95% H, and 26.2% O by mass. $C_7H_6O_2$

c. The EF of a compound is CHOCl. The molar mass of the compound is $\frac{129\ g}{mole}$. Calculate and determine the molecular formula. $C_2H_2O_2Cl_2$

Find the formula for the hydrate that contains 0.737g $MgSO_3$ and 0.763g H_2O.

$MgSO_3 \cdot \underline{6}\ H_2O$ ~~$MgSO_3 \cdot 0.763$~~

~~10~~ 34

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

$7.5g\ HCl \times \frac{1\ mol}{36.458} = 0.2057\ mol\ HCl \times \frac{2\ AlCl_3}{6\ HCl} = 0.06856\ mole\ HCl$

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

Remaining is: $7.5 - 4.054 = 3.446g$ HCl Remains (d)

(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

35 Determine # core e^- in O:

$1s^2 | 2s^2 2p^4$

(2) core

36 Determine # core e^- in ^{19}K

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6 | 4s^1$

18

37 Calc Zeff for Valence N

(2) $1s^2 | 2s^2 2p^3$ (5)

$Z_{eff} = 7 - 2 = 5$

38 Write the EC for $^{13}Al^{+3}$

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