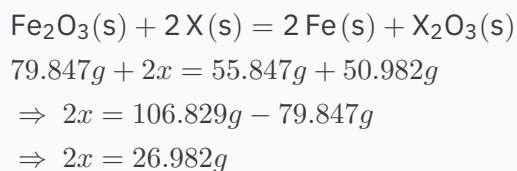# Ap Chem Summer Assignment #3

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September 5, 2021

1 The following reaction was performed, Identify element X.

$$Fe_2O_3(s) + 2\,X(s) = 2\,Fe(s) + X_2O_3(s)$$
$$79.847g + 2x = 55.847g + 50.982g$$
$$\Rightarrow\ 2x = 106.829g - 79.847g$$
$$\Rightarrow\ 2x = 26.982g$$

Since the atomic weight of Fe is proportional to the given weight ($55.847g$), the atomic weight of X is equally proportional to the derived weight ($26.982g$). Therefore, the element is Aluminium (Al).

2 Fill in the blanks to balance the following chemical equations:

a. $2\,AgI + Na_2S \rightarrow Ag_2S + 2\,NaI$

b. $(NH_4)_2Cr_2O_7 \rightarrow Cr_2O_3 + N_2 + 4\,H_2O$

c. $Na_3PO_4 + 3\,HCl \rightarrow 3\,NaCl + H_3PO_4$

d. $TiCl_4 + 2\,H_2O \rightarrow TiO_2 + 4\,HCl$

e. $Ba_3N_2 + 6\,H_2O \rightarrow 3\,Ba(OH)_2 + 2\,NH_3$

f. $3\,HNO_2 \rightarrow HNO_3 + 2\,NO + H_2O$

3 Balance the following equation:

$$4\,NH_4OH(aq) + KAl(SO) \cdot 12\,H_2O = Al(OH)_3(s) + 2\,(NH_4)_2Cr_2O_7 + KOH(aq) + 12\,H_2O$$
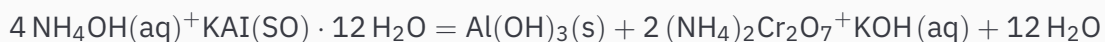
We can multiple NH_4OH by 4, and increase NH4 and H2O on the product side to compensate

4 Balance the following equation

The balanced equation is: $2\,Fe + 6\,HC_2H_3O_2 = 2\,Fe(C_2H_3O_2)_3 + 3\,H_2$

5 How many grams of water vapor can be generated from the combustion of 18.74 g of ethanol (C 2 H 6 O)?

First we need to balance the reaction: $2\,CH_3CH_2OH + 7\,O_2 = 4\,CO_2 + 6\,H_2O$
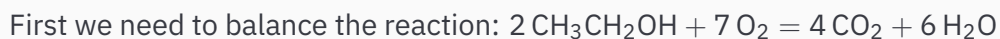
From that we can calculate the following:

$$18.74 = 0.4068 mol$$
$$0.4068 mol * (6 mol H_2O / 2 mol) = 1.22 mol H_2O$$
$$1.22 mol = 21.99 g$$

Therefore, we will get 21.99g of water vapor

6 How many grams of potassium iodide are necessary to completely react with 20.61g of Mercury (II) chloride

First we balance the equation

$HgCl_2 + 2\,KL = HgI_2 + 2\,KCl$
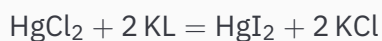
Next we to find the total atomic weight.

$$200.59 + 2(35.45) + 2(39.10 + 126.90)$$

Afterwards, we calculate the ratio needed

$$\frac{332}{271.49} = 1.22$$

Finally we multiply

$$20.61 * 1.22 = 25.20$$

7 A reaction combines 113.484 g of lead (II) nitrate with 45.010 g of sodium hydroxide (NaOH[aq]).

The equation for the reaction is $Pb(NO_3)_2 + 2\,NaOH \rightarrow Pb(OH)_2 + 2\,NaNO_3$

a. 83.4 grams of $Pb(OH)_2$

b. The limiting reactant is lead (II) nitrate (0.345837 mol) and the excess reactant left over is sodium hydroxide (1.7773 mol).

c. There is 57.256 grams of the excess reactant left over.

d. The percent yield is 95.9%.

8 A reaction combines 64.81 grams of silver nitrate with 92.67 grams of potassium bromide

The equation for the reaction is $AgNO_3 + KBr \rightarrow AgBr + KNO_3$

a. 72g

b. $AgNO_3$ is the limiting reactant

c. 47.3g

d. 20.5%

9 The moleculer weight of an insecticide, dibromoethane, is 187.9. Its molecular formula is $C_2H_4Br_2$, What percent by mass of bromine does dibromoethane contain?

First we have the following variables

$$C = 12.011$$
$$H = 1.008$$
$$Br = 79.90$$

Since the formula is $C_2H_4Br_2$, we can substitute and do the following:

$$= 24.022 + 4.032 + 159.8$$
$$= 187.9$$
$$= 159.8/187.9$$
$$= .8505$$

Therefore, dibromoethane contains 85.05 percent by mass of bromine.

10 A given sample of xenon fluoride contains molecules of a single type of XeF_n, where n is some whole number.

First, we need to calculate how many moles of xenon fluoride there are, and calculate its weight.

$$moles = 9.03 * 10^{20}/6.022 * 10^{23}$$
$$= 1.5 * 10^{-}3$$
$$= 0.31g$$

Now, we can calculate for n

$$= 0.31/131 + 19n$$
$$= 186.5 + 23.5n = 310$$
$$n = 4$$

Therefore its formula is XeF$_4$

11 A 6.32 g sample of potassium chlorate was decomposed according to the following equation, how many moles were formed?

We have the following values:
$$k = 39.0983g$$
$$Cl = 35.45g$$
$$O = 16.00g$$

From there we can calculate the total molar mass
$$39.0983 + 35.45 + 3 * 16 = 122.55g$$

We can then calculate the moles using the following equations
$$6.32/122.55 = 6.052 moles$$
$$2mol KClO3 = 3mol O2$$
$$2 = 3$$
$$0.052 * 3/2$$
$$= 0.078mol$$

12 What is the coefficient in front of water, when it is produced from the reaction of hydrochloric acid with calcium hydroxide? Calcium chloride is the other product.

The equation is Ca(OH)$_2$ $+$ 2HCl $=$ CaCl$_2$ + 2 H$_2$O

Therefore the coeffecient is 2

13 What is the subscript of aluminum in the formula of aluminum phosphate?

Aluminum has a subscript of 1 in $AlPO_4$

14 The reaction of 11.9 g of CHCl 3 with excess chlorine produced 12.6 g of CCl 4 , carbon tetrachloride, what is the percent yield?

The equation for the reaction is $2\,CHCl_3 + 2\,Cl_2 = 2\,CCl_4 + 2\,HCl$

The molar mass's for the two molecules are $CHCl_3 = 119.378$ $CCl_4 = 153.823$

The theoretical mass is $153.823*0.097 = 15.336g$ Therefore, the percent yield is $12.6/15.336 = .8216$, or %82.16

15 What mass of CCl 4 is formed by the reaction of 8.00 g of methane with an excess of chlorine? Ch4 is the limiting reactant

We get the following equations

$$8 * 1mol CH_4 = 8mol CH_4$$
$$8mol CH_4/16.04 = .499$$
$$.499 * 153.82 = 76.72g$$

Therefore, the solution is $76.72g$

16 A reaction occurs between sodium carbonate and hydrochloric acid producing sodium chloride, carbon dioxide, and water. Write the balanced chemical equation for the reaction.

The equation will be sodium carbonate + hydrohloric acid = sodium chloride + carbon doxide + water. In correct notation this is written as:

$$Na_2CO_3 + HCl + NaCl + CO_2 + H_2O$$
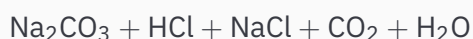
Balanced, this equation is

$$Na_2CO_3 + 2\,HCl + 2\,NaCl + 2\,CO_2 + H_2O$$

17 Classify the type of reaction from the five major type of reactions you learned in your first year chemistry course and write word equations. If necessary, balance.

a. $NaOH + KNO_3 = NaNO_3 + KOH$ is a double replacement reaction

b. $CH_4 + 2\,O_2 = CO_2 + 2\,H_2O$ is a combustion reaction

c. $Fe + 3\,NaBr = FaBr_2 + {}_3Na$ is a single replacement

d. This equation is already balanced, and is a double replacement reaction

e. This equation is already balanced, and is a double replacement reaction

f. This equation is already balanced, and is a synthesis reaction

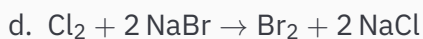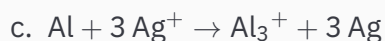g. This equation is already balanced, and is a decomposition reaction

18 Now try these recation types, Rewrite as a balanced equation with the products predicted

a. $Ba(OH)_2 \rightarrow BaO + H_2O$

b. $Na_2CO_3 \rightarrow Na_2O + CO_2$

c. $2\,LiClO_3 \rightarrow 2\,LiCl + 3\,O_2$

d. $Al_2O_3 \rightarrow 2\,Al_2 + O_3$

e. $H_2SO_4 \rightarrow H_2O + SO_3$

19 Now try these recation types, Rewrite as a balanced equation with the products predicted

a. $2\,Mg + O_2 \rightarrow 2\,MgO$

b. $N_2 + 3\,H_2 \rightarrow 2\,NH_3$

c. $S + O_2 \rightarrow SO_2$

d. $CaO + H_2O \rightarrow Ca(OH)_2$
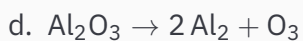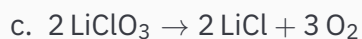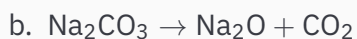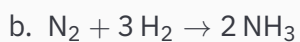
20 Attempt to write and predict products the following chemical reactions:

a. $2\,H_2O_2 \rightarrow 2\,H_2O + O_2$

b. $Cu^{2+} + So_4{}^{2-} + Ba^{2+} + 2\,OH^- \rightarrow Cu(OH)_2 + BaSO_4$

c. $Al + 3\,Ag^+ \rightarrow Al_3{}^+ + 3\,Ag$

d. $Cl_2 + 2\,NaBr \rightarrow Br_2 + 2\,NaCl$

e. $C_2H_6 + 3\,O_2 \rightarrow CO_2 + CO + 3\,H_2O$

21 Using the solubility rules table, classify each of the substances as being soluble or insoluble in water. Then, Identify the two new compounds that form if the solutions, as suggested by the following table, were mixed via a double displacement reaction.

21.1 Part A

a. KBr = Soluble

b. $PbCO_3$ = Insoluble

c. $BaSO_4$ = Insoluble

d. zinc hydroxide = Insoluble

e. sodium acetate = Soluble

f. silver iodide = Insoluble

g. cadmium (II) sulfide = Insoluble

h. zinc carbonate = Insoluble

i. silver acetate = Soluble

j. copper (II) sulfide = Insoluble

k. $Mg_3(PO4)_2$ = Insoluble

l. KOH = Soluble

m. $NiCl_2$ = Soluble

n. NH_4OH = Soluble

o. Hg_2SO_4 = Insoluble

p. PbI_2 = Insoluble

21.2 Part B

Kbr	Na$_2$Co$_3$	CaS	NH$_4$OH
AgBr(s), KNO$_3$(aq)	Ag$_2$CO$_3$(s), NaNO$_3$(aq)	Ag$_2$S(s), Ca(NO$_3$)$_2$(aq)	AgOH(s), NH$_4$NO$_3$(aq)
BaBr$_2$(aq), KCl(aq)	NaCl(aq), BaCO$_3$(s)	CaCl(aq), BaS(aq)	Ba(OH)$_2$(aq), NH$_4$Cl(aq)
AlBr$_3$(aq), KNO$_3$(aq)	Al$_2$(CO$_3$)$_3$(s), NaNO$_3$(aq)	AlBr$_3$(aq), Al$_2$S$_3$(s)	Al(OH)$_3$(aq), NH$_4$NO$_3$(aq
K$_2$SO$_4$(aq), CuBr$_2$(aq)	CuCO$_3$(s), NaSO$_4$(aq)	K$_2$SO$_4$(aq), CuS(s)	NH$_4$(SO$_4$)$_2$(aq), Cu(OH)$_2$

22 Name the following, then draw the Lewis Structure for the following hydrocarbons from their full names.

a. CH$_4$ - methane

b. C$_3$H$_8$ - propane

c. C$_4$H$_8$ - butene

d. C$_4$H$_8$ - butyne

22.1 Draw Lewis Structures for the following

a. Ethane C$_2$H (c-c)

b. Methane CH$_4$ (c-c)

c. Propyne C$_3$H$_4$ (c—c)

d. 2 · Butene 2 C$_4$H$_8$ (c—c)