3/15/16

Stoich. Hmwk:

1. $Pb + 2HCl(aq) \rightarrow PbCl_2 + H_2(aq)$

a) given: 0.36 mol Pb need: ? mol HCl Type: mol → mol

$0.36 \text{ mol Pb} \times \frac{2 \text{ mol HCl}}{1 \text{ mol Pb}} = \boxed{0.72 \text{ mol HCl}}$

2sf

b) given: 4.3 mol HCl need: ? mol H_2 Type: mol → mol

$4.3 \text{ mol HCl} \times \frac{1 \text{ mol } H_2}{2 \text{ mol HCl}} = 2.15 \rightarrow \boxed{2.2 \text{ mol } H_2}$

2sf

2. $N_2O_5 + H_2O \rightarrow 2\,HNO_3$ given: 0.51 mol N_2O_5 need: ? mol HNO_3

$0.51 \text{ mol } N_2O_5 \times \frac{2 \text{ mol } HNO_3}{1 \text{ mol } N_2O_5} = \boxed{1.0 \text{ mol } HNO_3}$

2sf

2b.) given: 1.2 mol N_2O_5 need: ? mol H_2O Type: mol → mol

$$1.2 \text{ mol } N_2O_5 \times \frac{1 \text{ mol } H_2O}{1 \text{ mol } N_2O_5} = \boxed{1.2 \text{ mol } H_2O}$$

3. $\_C + \underline{2}\, ZnO \rightarrow \underline{2}\, Zn + \_CO_2$

a) given: 0.38 mol ZnO need: ? mol CO_2 Type: mol → mol

$$0.38 \text{ mol } ZnO \times \frac{1 \text{ mol } CO_2}{2 \text{ mol } ZnO} = \boxed{0.19 \text{ mol } CO_2}$$

2sf

b) given: 3.7 mol Zn need: ? mol ZnO Type: mol → mol

$$3.7 \text{ mol } Zn \times \frac{2 \text{ mol } ZnO}{2 \text{ mol } Zn} = \boxed{3.7 \text{ mol } ZnO}$$

4. $Br_2(g) + 2\,NaI \rightarrow 2\,NaBr + I_2(g)$

a) given: 0.69 mol Br_2 need: ? g NaBr Type: mole → mass

$$0.69\ \text{mol}\ Br_2 \times \frac{2\ \text{mol NaBr}}{1\ \text{mol}\ Br_2} \times \frac{102.90\ \text{g NaBr}}{1\ \text{mol NaBr}} = 142 \rightarrow \boxed{140\ \text{g NaBr}}$$

2sf

molar ratio

1.42×10^2 1.4×10^2

b) given: 20.0 g Br_2 need: ? mol I_2 Type: mass → mol

$$20.0\ \text{g}\ Br_2 \times \frac{1\ \text{mol}\ Br_2}{159.80\ \text{g}\ Br_2} \times \frac{1\ \text{mol}\ I_2}{1\ \text{mol}\ Br_2} = \boxed{1.25 \times 10^{-1}\ \text{or}\ 0.125\ \text{mol}\ I_2}$$

3sf

5. $2\,P + 3\,Br_2(g) \rightarrow 2\,PBr_3$ given: 8.78 g Br_2 need: ? g PBr_3 Type: mass → mass

a) $$8.78\ \text{g}\ Br_2 \times \frac{1\ \text{mol}\ Br_2}{159.80\ \text{g}\ Br_2} \times \frac{2\ \text{mol}\ PBr_3}{3\ \text{mol}\ Br_2} \times \frac{270.67\ \text{g}\ PBr_3}{1\ \text{mol}\ PBr_3} = \boxed{9.91\ \text{g}\ PBr_3}$$

molar ratio

5b) $2P + 3Br_2(g) \rightarrow 2PBr_3$

given: 12.87 g P need: ? g PBr_3 Type: mass → mass

$$12.87\,g\,P \times \frac{1\,mol\,P}{30.97\,g\,P} \times \underbrace{\frac{2\,mol\,PBr_3}{2\,mol\,P}}_{\text{molar ratio}} \times \frac{270.67\,g\,PBr_3}{1\,mol\,PBr_3} = \boxed{112.5\,g\,PBr_3}$$

6. $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

a) given: $21.48\,g\,NH_3$ need: $?\,g\,N_2$ mass → mass

$$21.48\,g\,NH_3 \times \frac{1\,mol\,NH_3}{17.04\,g\,NH_3} \times \frac{1\,mol\,N_2}{2\,mol\,NH_3} \times \frac{28.02\,g\,N_2}{1\,mol\,N_2} = \boxed{17.66\,g\,N_2}$$

b) $$2.24\,g\,H_2 \times \frac{1\,mol\,H_2}{2.02\,g\,H_2} \times \frac{1\,mol\,N_2}{3\,mol\,H_2} \times \frac{28.02\,g\,N_2}{1\,mol\,N_2} = \boxed{10.4\,g\,N_2}$$

7. $2Al_2O_3 \longrightarrow 4Al + 3O_2(g)$

a) given: $9.8g\ Al_2O_3$ need: ? g Al mass → mass

$$9.8g\ Al_2O_3 \times \frac{1\ mol\ Al_2O_3}{101.96g\ Al_2O_3} \times \frac{4\ mol\ Al}{2\ mol\ Al_2O_3} \times \frac{26.98g\ Al}{1\ mol\ Al} = \boxed{5.2g\ Al}$$

b) given: $24.97g\ O_2$ need: ? g Al_2O_3 mass → mass

$$24.97g\ O_2 \times \frac{1\ mol\ O_2}{32.00g\ O_2} \times \frac{2\ mol\ Al_2O_3}{3\ mol\ O_2} \times \frac{101.96g\ Al_2O_3}{1\ mol\ Al_2O_3} = \boxed{53.04g\ Al_2O_3}$$

When volume is used replace molar mass with 22.4L.

Vol → vol

$$\text{amt given} \cdot \frac{1\text{ mol given}}{22.4\text{ L given}} \times \frac{\#\text{ mol needed}}{\#\text{ mol given}} \times \frac{22.4\text{ L needed}}{1\text{ mol needed}} =$$

mol → vol (2 conv.)

vol → mol (2 conv.)

mass → vol

$$\text{amt given} \times \frac{1\text{ mol given}}{\text{molar mass given}} \times \frac{\#\text{ mol needed}}{\#\text{ mol given}} \times \frac{22.4\text{ L needed}}{1\text{ mol needed}} =$$

vol → mass

$$\text{amt given} \times \frac{1\text{ mol given}}{22.4\text{ L given}} \times \frac{\#\text{ mol needed}}{\#\text{ mol given}} \times \frac{\text{molar mass needed}}{1\text{ mol needed}} =$$

Practice

$\_\_Mg + \underline{2}\ HCl(aq) \longrightarrow \_\_MgCl_2 + \_\_H_2(g)$

if 15.0g of Mg react, how many liters of hydrogen gas will be produced?

given: 15.0g Mg need: ? L H_2 Type: mass → vol

$$15.0\,g\,Mg \times \frac{1\,mol\,Mg}{24.31\,g\,Mg} \times \frac{1\,mol\,H_2}{1\,mol\,Mg} \times \frac{22.4\,L\,H_2}{1\,mol\,H_2} = \boxed{13.8\,L\,H_2}$$

$\_\_F_2(g) + \underline{2}\ KCl \longrightarrow \underline{2}\ KF + \_\_Cl_2(g)$

How many liters of $F_2(g)$ will produce 38.7L of $Cl_2(g)$

given: 38.7L Cl_2 need: ? L F_2 Type: vol → vol

$$38.7\,Cl_2 \times \frac{1\,mol\,Cl_2}{22.4\,L\,Cl_2} \times \frac{1\,mol\,F_2}{1\,mol\,Cl_2} \times \frac{22.4\,L\,F_2}{1\,mol\,F_2} = \boxed{38.7\,L\,F_2}$$