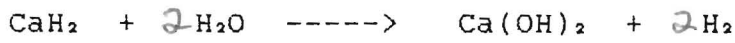


Teacher

Chemistry I
Chapter 11 Work Sheet

Mole - Mole

1. A portable hydrogen generator utilizes the reaction



How many grams of H₂ can be produced by a 50.0 g cartridge of CaH₂?

4.8(0) g 4.80 g

Mole - Mole

2. Iodine can be made by the reaction

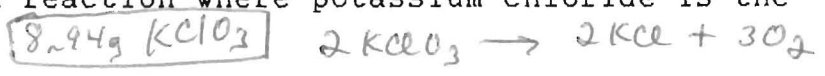


To produce each kg of iodine, how much NaIO₃ and how much NaHSO₃ must be used?

1.56 kg NaIO₃ 2.05 kg NaHSO₃

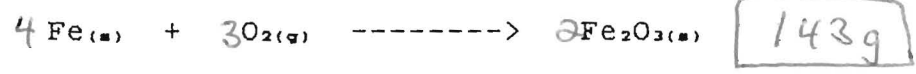
Mole - Mole

3. How much KClO₃ must be heated to obtain 3.50 g of oxygen in a decomposition reaction where potassium chloride is the other product?



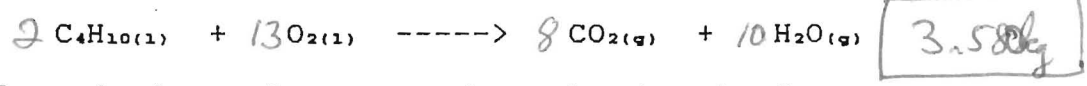
Mole - Mole

4. How much iron (III) oxide will be produced by the complete oxidation of 1.00 x 10² g of iron? The reaction is



143 g

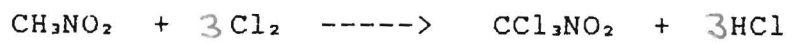
5. In a rocket motor fueled with butane, C₄H₁₀, how many kilograms of liquid oxygen should be provided with each kilogram of butane to provide for complete combustion?



3.58 kg

Mole

6. Chloropicrin, CCl₃NO₂, can be made cheaply for use as an insecticide by a process which utilizes the reaction



How much nitromethane, CH₃NO₂, is needed to form 500.0 g of chloropicrin?

~~186.1~~ g 185.7 g

M - M

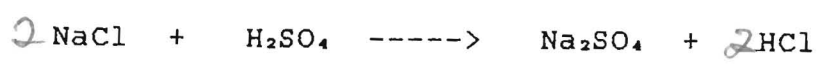
7. Ethyl alcohol, C₂H₅OH, is made by the fermentation of glucose, C₆H₁₂O₆, as indicated by the following reaction



How many grams of alcohol can be made from 2.00 g of glucose?

1.07 g

8. How much 83.4% pure salt cake (Na₂SO₄) could be produced from 2.50 x 10² g of 94.5% pure salt?



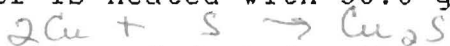
344 g

9. In the Mond process for purifying nickel, the volatile nickel carbonyl, $\text{Ni}(\text{CO})_4$, is produced by the following reaction



How much CO is used up in volatilizing each gram of nickel? *1.91g*

10. When copper is heated with an excess of sulfur, Cu_2S is formed. How many grams of Cu_2S could be produced if 100.0 g of copper is heated with 50.0 g of sulfur? *125g Cu₂S*



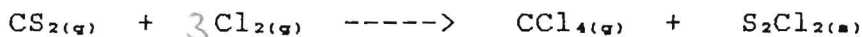
11. The reduction of Cr_2O_3 by Al proceeds quantitatively on ignition of a suitable fuse.



(a) How much metallic chromium can be made by bringing to reaction temperature a mixture of 5.0 g Al and 20.0 g Cr_2O_3 ? *9.6g Cr*

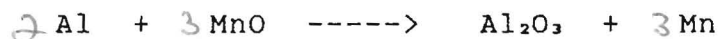
(b) Which reactant remains at the completion of the reaction, and how much? *5.9g Cr₂O₃*

12. A mixture of 1.00 kg of CS_2 and 2.00 kg of Cl_2 is passed through a hot reaction tube, where the following reaction takes place:



(a) How much CCl_4 can be made by complete reaction of the limiting starting material? (b) Which starting material is in excess, and how much of it remains unreacted? *1.45 kg CCl₄, 0.28(5) kg CS₂*

13. The following reaction proceeds until the limiting substance is all consumed.



A mixture containing 100.0 g Al and 200.0 g MnO was heated to initiate the reaction. Which initial substance remained in excess, and how much? *Al, 49.2()g 49.28g*

14. Determine the volume occupied by 4.0 g of oxygen at STP. *2.8L*

15. What volume of hydrogen will combine with 12 L of chlorine to form hydrogen chloride? What volume of hydrogen chloride will be formed? Assume STP. *12L H₂, 24L HCl*



16. What volume of hydrogen will unite with 6.0 L of nitrogen to form ammonia? What volume of ammonia will be produced? Assume STP.



18L H₂

12L NH₃

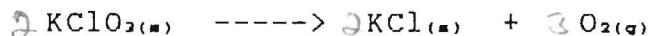
17. What volume of O_2 at STP is required for the complete combustion of 1.00 mole of carbon disulfide liquid? What volumes of CO_2 and SO_2 gas are produced at STP?



67.2 L O_2

22.4 L CO_2
44.8 L SO_2

18. How many liters of oxygen, at STP, can be obtained from 100.0 g of potassium chlorate?



27.4 L O_2

19. How many grams of zinc must be dissolved in sulfuric acid in order to obtain 500.0 mL of hydrogen gas at STP? (This is a single replacement reaction.)



1.46 g Zn

20. Exactly 500.0 mL of a gas at STP has a mass of 0.581 g. The composition of the gas is as follows: C = 92.24%, H = 7.76%. Derive its molecular formula.

C_2H_2

Chemistry I
Chapter 11 worksheet

$$1.) \frac{50.0 \text{ g } \text{CaH}_2}{42.02 \text{ g/mole}} = 1.190 \text{ mole Ca}$$



$$\frac{1 \text{ mole } \text{CaH}_2}{2 \text{ mole } \text{H}_2} = \frac{1.190 \text{ mole } \text{CaH}_2}{x \text{ mole } \text{H}_2}$$

$$x = 2.38 \text{ mole H}_2$$

$$2.38 \text{ mole } \text{H}_2 = \frac{x \text{ g}}{2.016 \text{ g/mole}}$$

$$\boxed{4.80 \text{ g } \text{H}_2}$$



$$(1 \text{ Kg}) = \frac{1000 \text{ g } \text{I}_2}{253.8 \text{ g/mole}} = 3.940 \text{ mole } \text{I}_2$$

$$\frac{1 \text{ mole } \text{I}_2}{2 \text{ mole } \text{NaIO}_3} = \frac{3.940 \text{ mole } \text{I}_2}{x \text{ mole } \text{NaIO}_3} \quad x = 7.880 \text{ mole } \text{NaIO}_3$$

$$7.880 \text{ mole } \text{NaIO}_3 = \frac{x \text{ g}}{197.9 \text{ g/mole}}$$

$$x = 1559 \text{ g or } \boxed{1.56 \text{ kg } \text{NaIO}_3}$$

$$\frac{1 \text{ mole } \text{I}_2}{5 \text{ mole } \text{NaHSO}_3} = \frac{3.940 \text{ mole } \text{I}_2}{x \text{ mole } \text{NaHSO}_3} \quad x = 19.70 \text{ mole } \text{NaHSO}_3$$

$$19.70 \text{ mole} = \frac{x \text{ g}}{104.06 \text{ g/mole}}$$

$$x = 2049 \text{ g or } \boxed{2.05 \text{ kg } \text{NaHSO}_3}$$



$$\frac{3.50\text{g O}_2}{32.0\text{g/mole}} = 0.1094\text{ mole O}_2$$

$$\frac{2\text{ mole KClO}_3}{3\text{ mole O}_2} = \frac{x\text{ mole KClO}_3}{0.1094\text{ mole O}_2}$$

$$x = 7.22 \times 10^{-2}\text{ mole KClO}_3$$

$$7.22 \times 10^{-2}\text{ mole} \times \frac{122.6\text{g/mole}}{1\text{ mole}} =$$

$$x = \boxed{8.94\text{g KClO}_3}$$



$$\frac{1.79\text{g Fe}}{55.8\text{g/mole}} = 0.0321\text{ mole Fe}$$

$$\frac{2\text{ Fe}_2\text{O}_3}{4\text{ Fe}} = \frac{x\text{ Fe}_2\text{O}_3}{0.0321\text{ Fe}}$$

$$x = 0.01605\text{ mole Fe}_2\text{O}_3$$

$$0.01605\text{ mole} \times \frac{159.7\text{g}}{1\text{ mole}} =$$

$$x = \boxed{2.56\text{g Fe}_2\text{O}_3}$$



$$\frac{1000 \text{g C}_4\text{H}_{10}}{58.12 \text{g/mole}} = 17.2 \text{ mole C}_4\text{H}_{10}$$

$$\frac{13 \text{ mole O}_2}{2 \text{ mole C}_4\text{H}_{10}} = \frac{x \text{ mole O}_2}{17.2 \text{ mole C}_4\text{H}_{10}}$$

$$x = 111.9 \text{ mole O}_2$$

$$111.9 \text{ mole O}_2 = \frac{x \text{ g}}{32.00 \text{ g/mole}}$$

$$3579.7 \text{ g or } \boxed{3.580 \text{ kg O}_2}$$



$$\frac{500.0 \text{g CCl}_3\text{NO}_2}{164.27 \text{g/mole}} = 3.042 \text{ mole CCl}_3\text{NO}_2$$

$$\frac{3.042 \text{ mole CCl}_3\text{NO}_2}{1 \text{ mole CCl}_3\text{NO}_2} = \frac{1 \text{ mole CH}_3\text{NO}_2}{1 \text{ mole CH}_3\text{NO}_2}$$

$$x = 3.042 \text{ mole CH}_3\text{NO}_2$$

$$3.042 \text{ mole CH}_3\text{NO}_2 = \frac{x \text{ g}}{61.04 \text{ g/mole}}$$

$$x = \boxed{185.7 \text{ g CH}_3\text{NO}_2}$$



$$\frac{2.00g \ C_6H_{12}O_6}{180.16g/mole} = 1.107 \times 10^{-2} \text{ mole } C_6H_{12}O_6$$

$$\frac{2 \text{ mole } C_2H_5OH}{1 \text{ mole } C_6H_{12}O_6} = \frac{X \text{ mole } C_2H_5OH}{1.107 \times 10^{-2} \text{ mole } C_6H_{12}O_6}$$

$$2.200 \times 10^{-2} \text{ mole } C_2H_5OH$$

$$2.200 \times 10^{-2} \text{ mole } C_2H_5OH = \frac{Xg}{46.07g/mole}$$

$$X = \boxed{1.02g \ C_2H_5OH}$$



$$(2.50 \times 10^0g)(0.245) = 236.25g \ NaCl \text{ in sample} \quad \frac{236.25g \ NaCl}{58.45g/mole} = 4.042 \text{ mole } NaCl$$

$$\frac{1 \text{ mole } Na_2SO_4}{2 \text{ mole } NaCl} = \frac{X \text{ mole } Na_2SO_4}{4.042 \text{ mole } NaCl}$$

$$2.021 \text{ mole } Na_2SO_4$$

$$2.021 \text{ mole } Na_2SO_4 = \frac{Xg}{142.0g/mole}$$

$$287.0g \ Na_2SO_4$$

$$\frac{287.0g \ Na_2SO_4}{X} (100) = 83.4\% \text{ pure}$$

$$X = \boxed{344g}$$



7.) $\frac{1.00\text{g Ni}}{58.69\text{g/mol}} = 1.704 \times 10^{-2} \text{ mole Ni}$

Mole of Ni : Mole of CO = 1 : 4

(4) $(1.704 \times 10^{-2} \text{ mole}) = 0.06816 \text{ mole CO used}$

$0.06816 \text{ mole CO} = \frac{x}{28.01\text{g/mole}}$

$= \boxed{1.91\text{g CO}}$



$100.0\text{g} + 50.0\text{g}$

$\downarrow \quad \quad \downarrow$

$1.574\text{mole} + 1.560\text{mole}$ We need twice as many moles of Cu as of S so Cu is limiting reagent

$\frac{1.574 \text{ mole Cu}}{x \text{ mole Cu}_2\text{S}} = \frac{2 \text{ mole Cu}}{1 \text{ mole Cu}_2\text{S}}$

$x = 0.7870$

$\text{mole Cu}_2\text{S} = \frac{x}{159.2}$

$x = \boxed{125\text{g Cu}_2\text{S}}$



$$2.) \frac{5.0 \text{ g Al}}{26.98 \text{ g/mole}} = 0.1853 \text{ mole Al}$$

There must be twice as much (mole) of Al as of Cr_2O_3 . There is not so Al is limiting.

$$\frac{20.0 \text{ g Cr}_2\text{O}_3}{152.0} = 0.1316 \text{ mole Cr}_2\text{O}_3$$

0.1853 mole Al produces 0.1853 mole Cr

$$0.1853 \text{ mole Cr} = \frac{x \text{ g}}{51.996 \text{ g/mole}}$$

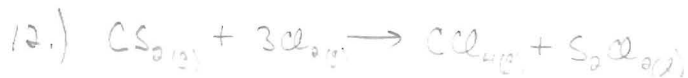
$$x = \boxed{9.6 \text{ g Cr}}$$

$$\frac{0.1853 \text{ mole Al used}}{x \text{ mole Cr}_2\text{O}_3 \text{ used}} = \frac{2 \text{ mole Al}}{1 \text{ mole Cr}_2\text{O}_3}$$

0.09265 mole Cr_2O_3 used leaves 0.03895 mole Cr_2O_3 left

$$0.03895 \text{ mole Cr}_2\text{O}_3 = \frac{x}{151.995}$$

$$x = \boxed{5.9 \text{ g Cr}_2\text{O}_3 \text{ remaining}}$$



$$1000 \text{ g CS}_2 \quad 2000 \text{ g Cl}_2$$

$$\downarrow \quad \downarrow$$

$$13.14 \text{ mole} \quad 28.21 \text{ mole}$$

Cl_2 is limiting

mole Cl_2 : mole $\text{CCl}_4 = 3:1$

So 9.40 mole CCl_4 is produced

$$9.40 \text{ mole} = \frac{x \text{ g}}{153.84 \text{ g/mole}}$$

$$x = 1446 \text{ g}$$

$$\text{or } \boxed{1.45 \text{ kg CCl}_4}$$

→ b.)

$$\frac{1 \text{ mole CS}_2}{3 \text{ mole Cl}_2} = \frac{x \text{ mole used of CS}_2}{28.21 \text{ mole Cl}_2 \text{ used}}$$

$$x = 9.40 \text{ mole CS}_2 \text{ used}$$

So 13.14 mole started - 9.40 mole used

3.74 mole remaining

$$3.74 \text{ mole CS}_2 = \frac{x \text{ g}}{76.13 \text{ g/mole}}$$

$$x = \boxed{285 \text{ g CS}_2 \text{ remaining}}$$



$$\frac{100.0\text{g Al}}{26.98\text{g/mole}} = 3.706\text{ mole Al}$$

$$\frac{200.0\text{g MnO}}{70.94} = 2.819\text{ mole MnO}$$

To react all of Mn we need only 1.897 mole Al. MnO is limiting reagent and Al is in excess by 1.827 mole.

$$1.827\text{ mole Al} = \frac{x\text{g}}{26.98\text{g/mole}} = \boxed{49.28\text{g Al in excess}}$$

1.00 mole of any gas at STP occupies 22.4 L.

$$\frac{4.0\text{g O}_2}{32.0\text{g/mole}} = 0.125\text{ mole O}_2$$

$$\frac{22.4\text{ L}}{1.00\text{ mole O}_2} = \frac{x\text{ L}}{0.125\text{ mole O}_2}$$

$$x = \boxed{2.8\text{ L of O}_2}$$



$$\frac{x \text{ mole Cl}_2}{12 \text{ L H}_2} = \frac{1 \text{ mole Cl}_2}{20.4 \text{ L Cl}_2}$$

$$x = 0.5357 \text{ mole Cl}_2$$

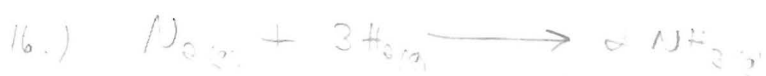
mole Cl_2 : mole $\text{H}_2 = 1:1$ therefore

$$0.5357 \text{ mole H}_2 \text{ or } \boxed{12 \text{ L of H}_2}$$

Two to one as many mole of $\text{HCl}(g)$ so

$$\boxed{24 \text{ L of HCl}}$$

* Note relationships of Volumes of gases that react



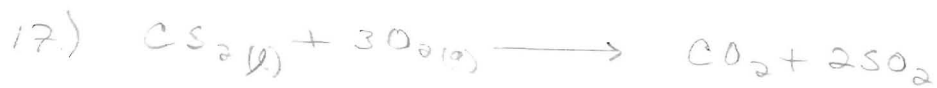
Volume ratios are

$$1\text{N}_2 : 3\text{H}_2$$

$$1\text{N}_2 : 2\text{NH}_3$$

Therefore 6.0 L of N_2 will react with $\boxed{18 \text{ L of H}_2}$ and

produce $\boxed{12 \text{ L of NH}_3}$



1.00 mole CS_2 requires 3.00 mole of O_2

$$\frac{X \text{ L}}{3.00 \text{ mole } \text{O}_2} = \frac{22.4 \text{ L}}{1.00 \text{ mole } \text{O}_2}$$

$$X = \boxed{67.2 \text{ L } \text{O}_2}$$



$$\frac{100.0 \text{ g } \text{KClO}_3}{122.55 \text{ g/mole}} = 0.81598 \text{ mole } \text{KClO}_3$$

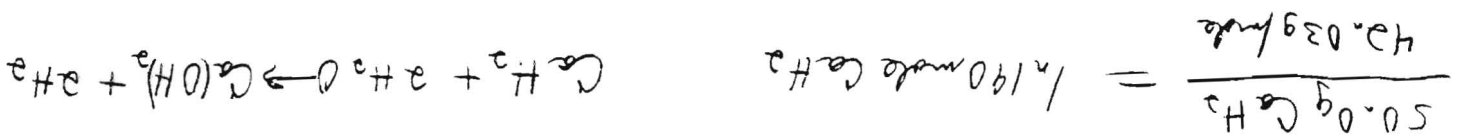
$$\frac{3 \text{ mole } \text{O}_2}{2 \text{ mole } \text{KClO}_3} = \frac{X \text{ mole } \text{O}_2}{0.81598}$$

$$X = 1.224 \text{ mole } \text{O}_2$$

$$\frac{22.4 \text{ L}}{1.00 \text{ mole } \text{O}_2} = \frac{X \text{ L}}{1.224 \text{ mole } \text{O}_2}$$

$$X = \boxed{27.4 \text{ L } \text{O}_2}$$

Chemistry I
Chapter 11 worksheet

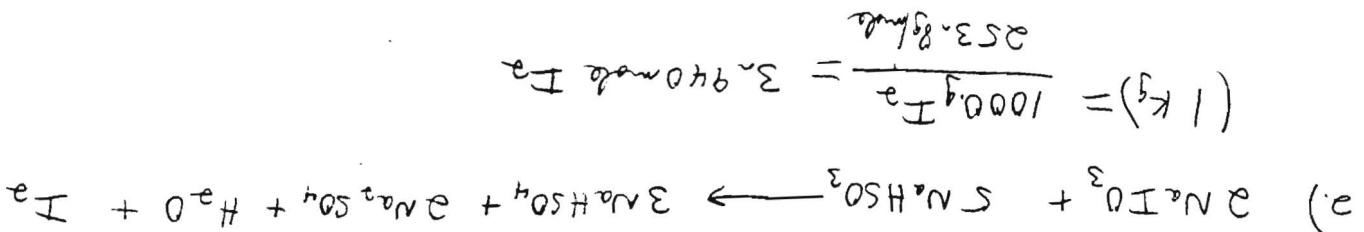


$$\frac{\text{mole CaH}_2}{1.190 \text{ mole CaH}_2} = \frac{2 \text{ mole H}_2}{x \text{ mole H}_2}$$

$$x = 2.38 \text{ mole H}_2$$

$$2.38 \text{ mole H}_2 = \frac{4.016 \text{ g/mole}}{x \text{ g}}$$

$$\boxed{4.80 \text{ g H}_2}$$



$$\frac{1 \text{ mole I}_2}{3.940 \text{ mole I}_2} = \frac{x \text{ mole NaIO}_3}{3.940 \text{ mole I}_2}$$

$$x = 7.880 \text{ mole NaIO}_3$$

$$7.880 \text{ mole NaIO}_3 = \frac{197.9 \text{ g/mole}}{x \text{ g}}$$

$$x = 1.559 \text{ g or } 1.56 \text{ kg}$$

$$\boxed{1.56 \text{ kg NaIO}_3}$$

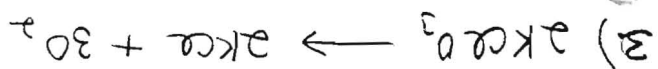
$$\frac{1 \text{ mole I}_2}{3.940 \text{ mole I}_2} = \frac{5 \text{ mole NaHSO}_3}{3.940 \text{ mole I}_2}$$

$$x = 19.70 \text{ mole NaHSO}_3$$

$$19.70 \text{ mole} = \frac{104.0 \text{ g/mole}}{x \text{ g}}$$

$$x = 2049 \text{ g or } 2.05 \text{ kg}$$

$$\boxed{2.05 \text{ kg NaHSO}_3}$$



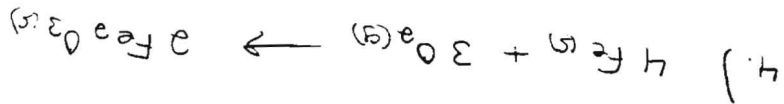
$$\frac{32.05 \text{ mole } O_2}{3.50 \text{ g } O_2} = 0.1094 \text{ mole } O_2$$

$$\frac{2 \text{ mole } KClO_3}{3 \text{ mole } O_2} = \frac{X \text{ mole } KClO_3}{0.1094 \text{ mole } O_2}$$

$$X = 2.293 \times 10^{-2} \text{ mole } KClO_3$$

$$\frac{132.60 \text{ g/mole}}{X \text{ g}} = \frac{2.293 \times 10^{-2} \text{ mole}}{X \text{ g}}$$

$$X = 8.94 \text{ g } KClO_3$$



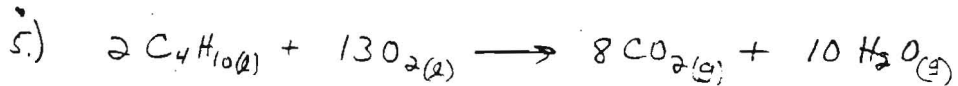
$$\frac{1.00 \times 10^2 \text{ g Fe}}{55.85 \text{ g/mole}} = 1.791 \text{ mole Fe}$$

$$\frac{2 \text{ mole } Fe_2O_3}{4 \text{ mole Fe}} = \frac{X \text{ mole } Fe_2O_3}{1.791 \text{ mole Fe}}$$

$$X = 0.8952 \text{ mole } Fe_2O_3$$

$$\frac{0.8952 \text{ mole}}{X \text{ g}} = \frac{159.7 \text{ g}}{X \text{ g}}$$

$$X = 143 \text{ g } Fe_2O_3$$



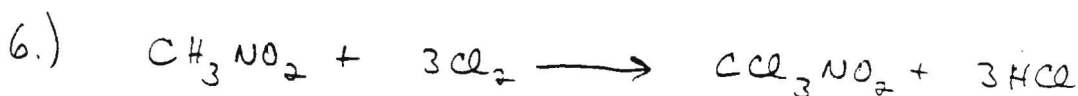
$$\frac{1000 \text{g C}_4\text{H}_{10}}{58.12 \text{g/mole}} = 17.2 \text{ mole C}_4\text{H}_{10}$$

$$\frac{13 \text{ moles O}_2}{2 \text{ moles C}_4\text{H}_{10}} = \frac{x \text{ mole O}_2}{17.2 \text{ mole C}_4\text{H}_{10}}$$

$$x = 111.9 \text{ mole O}_2$$

$$111.9 \text{ mole O}_2 = \frac{x \text{ g}}{32.00 \text{g/mole}}$$

$$3579.7 \text{ g or } \boxed{3.580 \text{ kg O}_2}$$



$$\frac{500.0 \text{g CCl}_3\text{NO}_2}{164.27 \text{g/mole}} = 3.042 \text{ mole CCl}_3\text{NO}_2$$

$$\frac{3.042 \text{ mole CCl}_3\text{NO}_2}{x \text{ mole CH}_3\text{NO}_2} = \frac{1 \text{ mole CCl}_3\text{NO}_2}{1 \text{ mole CH}_3\text{NO}_2}$$

$$x = 3.042 \text{ mole CH}_3\text{NO}_2$$

$$3.042 \text{ mole CH}_3\text{NO}_2 = \frac{x \text{ g}}{61.04 \text{g/mole}}$$

$$x = \boxed{185.7 \text{ g CH}_3\text{NO}_2}$$

$$x = 344 \text{ g}$$

$$287 \text{ g Na}_2\text{SO}_4 \times \frac{x}{100} = 83.4\% \text{ pure}$$

$$287 \text{ g Na}_2\text{SO}_4$$

$$\frac{142.04 \text{ g/mole}}{x \text{ g}} = 2.021 \text{ mole Na}_2\text{SO}_4$$

$$x = 2.021 \text{ mole Na}_2\text{SO}_4$$

$$\frac{\text{mole Na}_2\text{SO}_4}{x \text{ mole Na}_2\text{SO}_4} = \frac{\text{mole NaOH}}{x \text{ mole Na}_2\text{SO}_4}$$

$$236.25 \text{ mole} = 236.25 \text{ mole in sample} \times (0.945) = 223.25 \text{ mole NaOH}$$

$$\frac{223.25 \text{ mole}}{58.44 \text{ g/mole}} = 3.82 \text{ mole NaOH}$$



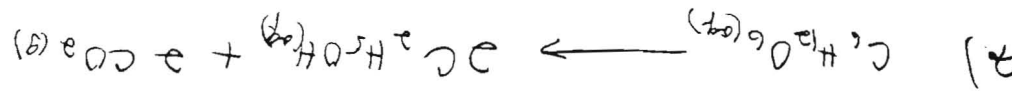
$$x = 1.02 \text{ g CaH}_2\text{O}_4$$

$$\frac{46.07 \text{ g/mole}}{x \text{ g}} = 2.20 \times 10^{-2} \text{ mole CaH}_2\text{O}_4$$

$$2.20 \times 10^{-2} \text{ mole CaH}_2\text{O}_4$$

$$\frac{\text{mole C}_6\text{H}_5\text{O}_6}{x \text{ mole C}_2\text{H}_2\text{O}_4} = \frac{1.11 \times 10^{-2} \text{ mole C}_6\text{H}_5\text{O}_6}{1.10 \times 10^{-2} \text{ mole C}_2\text{H}_2\text{O}_4}$$

$$2.00 \text{ g C}_6\text{H}_5\text{O}_6 = \frac{180.16 \text{ g/mole}}{1.11 \times 10^{-2} \text{ mole C}_6\text{H}_5\text{O}_6}$$





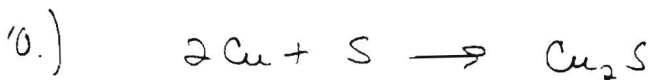
$$\frac{1200 \text{ g Ni}}{58.69 \text{ g/mole}} = 1.704 \times 10^{-2} \text{ mole Ni}$$

$$\text{Mole of Ni} : \text{Mole of CO} = 1 : 4$$

$$(4)(1.704 \times 10^{-2} \text{ mole}) = 0.06816 \text{ mole CO used}$$

$$0.06816 \text{ mole CO} = \frac{x \text{ g}}{28.01 \text{ g/mole}}$$

$$x = \boxed{1.91 \text{ g CO}}$$



$$100.0 \text{ g} + 50.0 \text{ g}$$

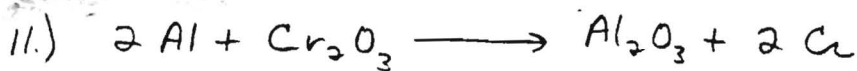
\downarrow \downarrow
 1.574 mole + 1.560 mole We need twice as many moles of Cu as of S so
 Cu is limiting reagent.

$$\frac{1.574 \text{ mole Cu}}{x \text{ mole Cu}_2\text{S}} = \frac{2 \text{ mole Cu}}{1 \text{ mole Cu}_2\text{S}}$$

$$x = 0.7870$$

$$\text{mole Cu}_2\text{S} = \frac{x}{159.2}$$

$$x = \boxed{125 \text{ g Cu}_2\text{S}}$$



$$a.) \frac{5.0 \text{ g Al}}{26.98 \text{ g/mole}} = 0.1853 \text{ mole Al}$$

There must be twice as much (mole) of Al as of Cr_2O_3 . There is not so Al is limiting.

$$\frac{20.0 \text{ g Cr}_2\text{O}_3}{152.0} = 0.1316 \text{ mole Cr}_2\text{O}_3$$

0.1853 mole Al produces 0.1853 mole Cr

$$0.1853 \text{ mole Cr} = \frac{x \text{ g}}{51.996 \text{ g/mole}}$$

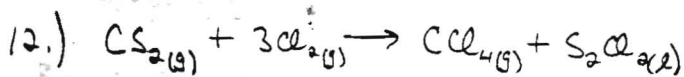
$$x = \boxed{9.6 \text{ g Cr}}$$

$$\frac{0.1853 \text{ mole Al used}}{x \text{ mole Cr}_2\text{O}_3 \text{ used}} = \frac{2 \text{ mole Al}}{1 \text{ mole Cr}_2\text{O}_3}$$

0.09265 mole Cr_2O_3 used leaves 0.03895 mole Cr_2O_3 left

$$0.03895 \text{ mole Cr}_2\text{O}_3 = \frac{x}{151.996}$$

$$x = \boxed{5.9 \text{ g Cr}_2\text{O}_3 \text{ remaining}}$$



$$1000 \text{ g CS}_2 \quad 2000 \text{ g Cl}_2$$

$$\downarrow \quad \downarrow$$

$$13.14 \text{ mole} \quad 28.21 \text{ mole}$$

Cl_2 is limiting

mole Cl_2 : mole $\text{CCl}_4 = 3 : 1$

So 9.40 mole CCl_4 is produced

$$9.40 \text{ mole} = \frac{x \text{ g}}{153.81 \text{ g/mole}}$$

$$x = 1446 \text{ g}$$

$$\text{or } \boxed{1.45 \text{ kg CCl}_4}$$

$$b.) \frac{1 \text{ mole CS}_2}{3 \text{ mole Cl}_2} = \frac{x \text{ mole used of CS}_2}{28.21 \text{ mole Cl}_2 \text{ used}}$$

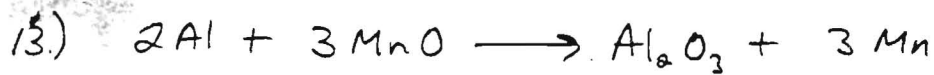
$$x = 9.40 \text{ mole CS}_2 \text{ used}$$

So 13.14 mole started - 9.40 mole used

3.74 mole remaining

$$3.74 \text{ mole CS}_2 = \frac{x \text{ g}}{76.13 \text{ g/mole}}$$

$$x = \boxed{285 \text{ g CS}_2 \text{ remaining}}$$



$$\frac{100.0\text{g Al}}{26.98\text{g/mole}} = 3.706 \text{ mole Al}$$

$$\frac{200.0\text{g MnO}}{70.94} = 2.819 \text{ mole MnO}$$

To react all of Mn we need only 1.897 mole Al. MnO is limiting reagent and Al is in excess by 1.827 mole.

$$1.827 \text{ mole Al} = \frac{x\text{g}}{26.98\text{g/mole}} = \boxed{49.28\text{g Al in excess}}$$

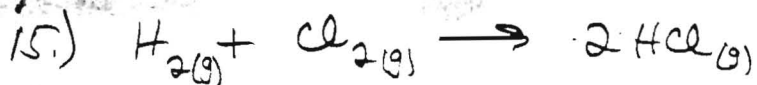
(4.)

1.00 mole of any gas at STP occupies 22.4 L.

$$\frac{4.0\text{g O}_2}{32.0\text{g/mole}} = 0.125 \text{ mole O}_2$$

$$\frac{22.4 \text{ L}}{1.00 \text{ mole O}_2} = \frac{x \text{ L}}{0.125 \text{ mole O}_2}$$

$$x = \boxed{2.8 \text{ L of O}_2}$$



$$\frac{x \text{ mole Cl}_2}{12 \text{ L Cl}_2} = \frac{1 \text{ mole Cl}_2}{22.4 \text{ L Cl}_2}$$

$$x = 0.5357 \text{ mole Cl}_2$$

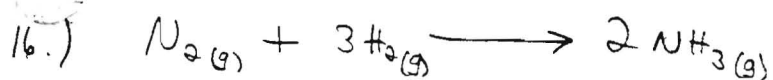
mole Cl_2 : mole H_2 = 1:1 therefore

$$0.5357 \text{ mole H}_2 \text{ or } \boxed{12 \text{ L of H}_2}$$

Two times as many moles of $\text{HCl}(\text{g})$ so

$$\boxed{24 \text{ L of HCl}}$$

* Note relationships of Volumes of gases that react

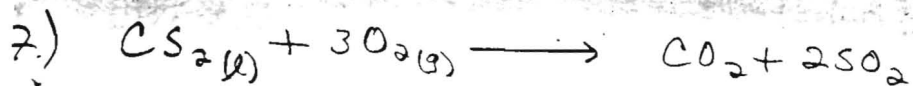


Volume ratios are

$$1 \text{ N}_2 : 3 \text{ H}_2$$

$$1 \text{ N}_2 : 2 \text{ NH}_3$$

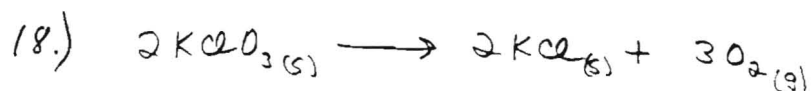
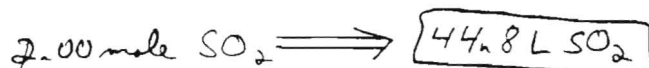
Therefore 6.0 L of N_2 will react with $\boxed{18 \text{ L of H}_2}$ and
produce $\boxed{12 \text{ L of NH}_3}$



1.00 mole CS_2 requires 3.00 mole of O_2

$$\frac{X \text{ L}}{3.00 \text{ mole } \text{O}_2} = \frac{22.4 \text{ L}}{1.00 \text{ mole } \text{O}_2}$$

$$X = \boxed{67.2 \text{ L } \text{O}_2}$$



$$\frac{100.0 \text{ g } \text{KClO}_3}{122.55 \text{ g/mole}} = 0.81598 \text{ mole } \text{KClO}_3$$

$$\frac{3 \text{ mole } \text{O}_2}{2 \text{ mole } \text{KClO}_3} = \frac{X \text{ mole } \text{O}_2}{0.81598}$$

$$X = 1.224 \text{ mole } \text{O}_2$$

$$\frac{22.4 \text{ L}}{1.00 \text{ mole } \text{O}_2} = \frac{X \text{ L}}{1.224 \text{ mole } \text{O}_2}$$

$$X = \boxed{27.4 \text{ L } \text{O}_2}$$