LIMITING REAGENT PROBLEMS

1. A 2 g of H_2 and 8 grams of O_2 are put in a closed container. How many grams of water can be obtained after the reaction?

2. 3 moles of SO_2 are allowed to react with 4 moles of O_2 to produce SO_3. How many moles of which gas are in excess?

3. 29.4 g of sulfuric acid reacted with 13 g of zinc.
What is the volume of evolved gas in liters at STP?

4. 4.16 g of barium chloride is reacted with 39.2 g of 2.5 % sulfuric acid solution. What is the mass of barium sulfate produced in grams?

5. 3 moles of CS_2 and 5 moles of O_2 gases are reacted according to the following reaction.

$$CS_2 + 3O_2 \rightarrow CO_2 + 2SO_2$$

In order to allow all the gases to react, how many moles of which gas must be added?

6. After the reaction of a certain mass of nitrogen gas with 12 g of hydrogen gas 4 g of nitrogen remains unreacted. What is the initial mass of nitrogen gas?

7. 8 g of carbon and 8 g of oxygen are allowed to react with each other to form carbon dioxide. How many grams of which element remain unreacted?

8. $Ca(CN)_2 + 3H_2O \rightarrow CaCO_3 + 2NH_3$
for the above reaction.
If 6 moles of each of the reactants are reacted
a. What is the excess reagent and how many grams is it?
b. What is the volume of the produced NH_3 at STP?
c. What is the mass of $CaCO_3$ that produced?

9. Equal masses for each of the elements Cu and S are reacted with each other by the following equation.

$$Cu + S \rightarrow CuS$$

What is the ratio of the mass of CuS produced to the mass of excess sulfur?

10. 8 grams of gas CO reacts with 28.4 grams of the gas Cl_2 in order to produce the gas $COCl_2$ in closed elastic container. What is the total volume of gases at STP in the container after the reaction? (C: 12 , O: 16 , Cl: 35.5)

11. 20 grams of Ca and 20 grams of Br_2 undergo reaction to produce $CaBr_2$. When one of the reactants is consumed up completely, how many grams of which of the compounds remains unreacted? (Ca: 40, Br:80)

12. When a sample of $CaCO_3$ is heated, 60% by mass of it decomposes and 6.72 L gas is produced at STP.
How many grams of $CaCO_3$ remain unreacted?

13. 3 moles of SO_2 gas reacts with 4 moles of O_2.
Which one is the excess and how many moles is it?

14. 0.02 moles of C_3H_4 reacts with $2.408 \cdot 10^{22}$ O_2 –molecules. How many grams of CO_2 is produced after the reaction?

15. At the same conditions, 9 liters of N_2 and 9 liters of H_2 gases react in order to produce NH_3.
Which gas will be excess and how many liters?

16. Equal volumes of N_2 and H_2 gases are reacted to give NH_3 at the same conditions.
After one of the reactants is completely used V liter of NH_3 gas is produced. Which one of the reactants remains unreacted and how many V liters?

17. How many grams of water can be produced at most when 4 g of hydrogen and 8 g of oxygen are reacted?

18. 18 g of carbon and 8 g of oxygen are reacted to form carbon dioxide. Which element and how many grams remain behind?

19. Equal weights of calcium and oxygen gas are reacted in a closed container to give 112 g of calcium oxide. Which element and how many grams will remain behind?

20. Equal volumes of sulfur dioxide and oxygen gases are reacted to give 5 liters of sulfur trioxide at the same conditions. Which one remains unreacted and how many liters?

21. What is the mole number of excess reagent when 36 g of pentane (C_5H_{12}) are burned with 112 L of oxygen at STP?

21. How many liters of CH_4 gas at STP are obtained from the reaction of 3 moles of Al_4C_3 with 108 g of water? The equation of the reaction is:

$$Al_4C_3 + 12H_2O \rightarrow 3CH_4 + 4Al(OH)_3$$

23. The mixture of 2 mol of H_2 and 2 mol of O_2 gases are ignited to obtain water .Which reactant is limiting?

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Which is the excess reactant? How much water will be produced?

24. Carborundum, SiC, is used as an abrasive. It is formed by the combination of SiO_2 and carbon, according to the reaction:

$SiO_2 + 3C \rightarrow SiC + 2CO$

What mass if SiC is formed from 6 grams of SiO_2 and 6 grams of C?

25. Given: $N_2\ (g) + 3\ H_2\ (g) \rightarrow 2NH_3\ (g)$

If 20 L of N_2 and 15 L of H_2 gases at the same conditions are reacted, which gas will be excess and how many liters ?

26. Given: $N_2\ (g) + 3H_2(g) \rightarrow 2NH_3(g)$

$3.01x10^{23}$ molecules of nitrogen and 3.36 L of H_2 at STP are reacted. How many grams of NH_3 are produced?

27. Aluminum and hydrogen bromide react according to the following reaction

$2Al + 6HBr \rightarrow 2AlBr_3 + 3H_2$

If 4mol and 9mol of HBr are allowed to react

A. which of the two reactants is the limiting one?

B. How many moles of the excess reactant are left at the end of reaction?

C. What is the maximum mole number of H_2 obtained?

28. Given the reaction;

$2H_2S\ (g) + 3O_2\ (g) \rightarrow 2H_2O\ (g) + 2SO_2\ (g)$.

The quantities of reactants of the reaction are given below .For each of the following, determine the excess reactant and the maximum grams of water produced.

A. 2 mol of H_2S and 4mol of O_2

B. 4mol of H_2S and 6mol of O_2

C. 8.5g of H_2S and 9.6g of O_2

D. 6.02×10^{22} H_2S molecules and 6.72L O_2 at STP

E. 4.48L H_2S at STP and 19.2g O_2

F. 17.92L H_2S at STP and 13.44 L O_2 at STP

28. Given the reaction:

$As_4O_6 + 4I_2 + 4H_2O \rightarrow 2As_2O_5 + 8HI$

what is the maximum grams of HI produced if 2mol of each of the reactant are reacted? (HI: 128)

30. Nitric oxide, NO, is prepared according to the following reaction in laboratories

$3KNO_2 + KNO_3 + Cr_2O_3 \rightarrow 4NO\ (g) + 2K_2CrO_4$

Calculate the maximum liters of NO at STP produced by the reaction if 100 g of each of the reactant?

31. Equal weights of sodium and chlorine gas are reacted in a closed container to give 0.1 mol of sodium chloride. Which element will remain behind and how many grams?

32. Equal moles of aluminum and oxygen are reacted to give 20.4 g of aluminum oxide. Which one remains unreacted and how many moles? (Al_2O_3: 102)

33. Equal volumes of sulfur dioxide and oxygen gases are reacted to give 5 liters of sulfur trioxide at the same conditions. Which one remains unreacted and how many liters?

34. Given reaction:

$2NH_3\ (g) + 3Cl_2\ (g) \rightarrow N_2\ (g) + 6HCl\ (g)$

Determine the quantity in moles of the excess reactant in each of the following cases. Calculate the maximum number of moles of HCl for each case for which the amount of reactants are given below.

A. 1mol of NH_3 and 1.5 mol of Cl_2

B. 7 mol of NH_3 and 9 mol of Cl_2

C. $6x\ 10^{22}$ NH_3 molecules and $21x\ 10^{22}$ Cl_2 molecules

D. 10.2 g of NH_3 and 134.9g of Cl_2

E. 1.12 L of NH_3 at STP and 4.48 L of Cl_2 at STP

35. Aluminum carbide, Al_4C_3, reacts with HCl to produce aluminum chloride and methane gas, CH_4.How many liters of CH_4 (g) at STP will be produced by the reaction of 0.2 mol of Al_4C_3 with 1.2 mol of HCl?

36. Given the skeleton equation:

$FeS_2\ (s) + O_2\ (g) \rightarrow Fe_2O_3\ (s) + SO_2\ (g)$

Calculate the maximum mass of Fe_2O_3 produced when 24 g of FeS_2 is reacted with 16.8 L of O_2 at STP. Which of the two reactants is the limiting reactant? How much of the excess reactant is left at the end of reaction.

37. Balance the equation for the reaction of Mg_3N_2 with H_2O to form $Mg(OH)_2$ and NH_3. What is the maximum number of grams of NH_3 that can be produced from 1.00 g of Mg_3N_2 and 1.50 g of H_2O?

38. How many grams of N_2F_4 can theoretically be prepared from 17 g of NH_3 and 38 g of F_2? (N: 14, F: 19) The chemical equation for the reaction is :

$2NH_3 + 5F_2 \rightarrow N_2F_4 + 6HF$

39. How many grams of beryllium fluoride, BeF_2, can be prepared from 18g of beryllium and 19 g of fluorine?

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40. What mass of MoF_5 is obtained from 42 g of MoF_6 and 66 g of $Mo(CO)_6$ by the reaction :

$$5MoF_6 + Mo(CO)_6 \rightarrow 6MoF_5 + 6CO$$

41. Given equations :

$$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2\,(g) + 2H_2O$$

How many liters of chlorine gas at STP will be produced from 43.5 g of manganese dioxide and 36.5 g of hydrogen chloride?

42. When equal weights of X and Y are reacted to give one mole of the compound X_2Y_3, 64 g of Y remains unreacted. If the atomic weight of Y is 16 g, what is the atomic weight of X?

43. Given the equation:

$$2SO_2\,(g) + O_2\,(g) + 2H_2O\,(l) \rightarrow 2\,H_2SO_4\,(l)$$

Calculate the maximum moles of H_2SO_4 produced by the reaction of 4 mol of SO_2, 2mol of O_2, and 3 mol of H_2O.

44. Equal number of moles of iron and oxygen are reacted to form 32 g of iron (III) oxide. Which element and how many grams remain behind?

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