LR Examples

1. At high temperatures, sulfur combines with iron to form the brown-black iron (II) sulfide:

Fe (s) + S (l) → FeS (s)

In one experiment, 7.62 g of Fe are allowed to react with 8.67 g of S.

1. What is the limiting reagent
2. What is the reactant in excess?
3. Calculate the mass of FeS formed.
4. What is the theoretical yield of FeS?
5. How much Fe is used?
6. How much S is used?
7. How much Fe is in excess?
8. How much S is in excess?

2. Arcylonitrile, C3H3N, is the starting material for the production of a kind of synthetic fiber

acrylics) and can be made from propylene, C3H6, by reaction with nitric oxide, NO, as follows:

4 C3H6 (g) + 6 NO (g) → 4 C3H3N (s) + 6 H2O (l) + N2 (g)

1. What mass of C3H3N can be made when 21.6 g of C3H6 react with 21.6 g of nitric oxide?
2. If 19.08 g of C3H3N is actually produced, what is the % yield of C3H3N?

3. Calculate the percent yield for the reaction: P4(s) + 6 Cl2(g) → 4 PCl3(l)

if 75.0 g of phosphorus reacts with excess chlorine gas to produce 111.0 g of phosphorus trichloride.

4. Formic acid, HCHO2, burns in oxygen to form carbon dioxide and water as follows:

2 HCHO2 (aq) + O2 (g) → 2 CO2 (g) + 2 H2O (l)

1. If a 3.15-g sample of formic acid was burned in 2.0 L of oxygen, what volume of carbon dioxide would be produced? (Assume the reaction occurs at standard temperature and pressure, STP.)

5. Zinc metal reacts with hydrochloric acid to produce zinc chloride and hydrogen gas @ STP.

a. Balance the following reaction: Zn (s) + HCl (aq) → ZnCl2 (aq) + H2 (g)

b. A 3.50-g sample of zinc metal is allowed to react with 2.50 g of hydrochloric acid.

Complete the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Reactants/products | Zn (grams) | HCl (grams) | ZnCl­2 (grams) | H2 (L) |
| Before reaction |  |  |  |  |
| After reaction | 1.26 g |  |  |  |

6. Consider the reaction: MnO2 + 4 HCl → MnCl2 + Cl2 + 2 H2O

If 0.45 mols of MnO2 can react with 48.2 g of HCl, how many grams of Cl2 could be produced?

7. One of the components of the fuel mixture on the Apollo lunar module involved a reaction with hydrazine, N2H4, and dinitrogen tetraoxide, N2O4. If the balanced equation for this reaction is

2 N2H4 (l) + N2O4 (g) → 3 N2 (g) + 4 H2O (g),

what volume of N2 gas (measured at STP) would result from the reaction of 1500 kg of hydrazine and 1000 kg of N2O4?

8. Calculate the percent yield for an experiment in which 5.50 g of SOCl2 was obtained in a reaction of 5.80 g of SO2 with excess PCl5. Use the following equation:

SO2 (l) + PCl5 (l) → SOCl2 (l) + POCl3 (l).

9. Chlorine gas reacts with silica, SiO2, and carbon to give silicon tetrachloride and carbon monoxide.

a. Balance the following equation: Cl2(g) + SiO2(s) + C(s) → SiCl4(l) + CO(g)

b. How much CO gas can be produced from 15.0 g of silica?

10. When iron (II) hydroxide is mixed with phosphoric acid, iron (II) phosphate precipitate results.

a. Balance the following equation:

Fe(OH)2(aq) + H3PO4(aq) → Fe3(PO4)2(s) + H2O(l)

b. If 3.20 g of Fe(OH)2 is treated with 2.50 g of phosphoric acid, what is the limiting reagent and what is the reactant in excess?

c. How many grams of Fe3(PO4)2 precipitate can be formed?

d. If 3.99 g of Fe3(PO4)2 is actually obtained, what is the percent yield?