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 moles of Fe are allowed to react with 8.67 moles of S.

* 1. What is the limiting reagent, and what is the reactant in excess?
  2. Calculate the number of moles of FeS formed.

1. 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)

How many moles of C3H3N can be made when 21.6 moles of C3H6 react with 21.6 moles of nitric oxide?

1. Calculate the moles of PCl2 produced for the reaction: P4 (s) + 6 Cl2 (g) → 4 PCl3 (l) if 75.0 moles of phosphorus reacts with 111.0 moles of chlorine gas.
2. Formic acid, HCHO2, burns in oxygen to form carbon dioxide and water as follows:

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

If a 3.15 mole sample of formic acid was burned in 19.0 moles of oxygen, how many moles of carbon dioxide would be produced?

1. Zinc metal reacts with hydrochloric acid to produce zinc chloride and hydrogen gas.
   1. Balance the following reaction: Zn (s) + HCl (aq) → ZnCl2 (aq) + H2 (g)
   2. A 3.50 mole sample of zinc metal is allowed to react with 4.0 moles of hydrochloric acid.

Complete the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Reactants/products | Zn (moles) | HCl (moles) | ZnCl2 (moles) | H2 (moles) |
| Initial |  |  |  |  |
| Change |  |  |  |  |
| End |  |  |  |  |

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

If 1.45 mols of MnO2 can react with 148.2 grams of HCl, how many moles of Cl2 could be produced?

1. 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),

How many moles of N2 would result from the reaction of 150 g of hydrazine, N2H4, molar mass 32.03g/mol and 1000 g of N2O4, molar mass 92.00g?

1. Calculate the moles of POCl3 produced in an experiment in which 5.50 g of PCl5 reacts with 5.80 g of SO2. Use the following equation:

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

1. Chlorine gas reacts with silica, SiO2, and carbon to give silicon tetrachloride and carbon monoxide.
   1. Balance the following equation: Cl2 (g) + SiO2 (s) + C (s) → SiCl4 (l) + CO (g)
   2. How many grams of CO can be produced from 15.0 g of silica and an excess of other reactants?
2. When iron (II) hydroxide is mixed with phosphoric acid, iron (II) phosphate precipitate results.
   1. Balance the following equation: Fe(OH)2 (aq) + H3PO4 (aq) → Fe3(PO4)2 (s) + H2O (l)
   2. 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?
   3. How many grams of Fe3(PO4)2 precipitate can be formed?
   4. If 3.99 g of Fe3(PO4)2 is actually obtained, what is the percent yield?