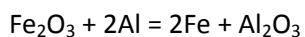The thermite reaction has been used to weld railroad rails, make bombs, and ignite solid rocket fuel. The equation of the reaction is:

 a.) What is the theoretical yield of iron if 100.0 g of Fe_2O_3 is used?

 b.) What is the percentage yield if 52.3 g of iron is actually produced?

Solution:

The equation of the reaction is:
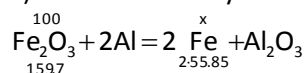
Fe_2O_3 + 2Al = 2Fe + Al_2O_3

Begin by determining the molar mass of each compound involved in the reaction.
Using atomic masses from the periodic table, we will find the following:
M(Fe_2O_3) = 159.7 g/mol;
Ar(Fe) = 55.85 g/mol.
a) The theoretical yield of iron determine from the equation of the reaction:

$$\overset{100}{\underset{159.7}{Fe_2O_3}} + 2Al = 2\overset{x}{\underset{2\cdot 55.85}{Fe}} + Al_2O_3$$

$$m(Fe) = \frac{100 \cdot 2 \cdot 55.85}{159.7} = 69.9\,g$$

b) The percentage yield of iron is:

$$\eta = \frac{52.3}{69.9} \cdot 100\% = 74.8\%.$$

Answer:
   a) m(Fe)=69.9 g;
   b) yield of iron is 74.8%