Answer on the question #54716 – Chemistry – General chemistry

Question:

Balance the chemical equation given below, and determine the number of grams of MgO are needed to produce 20.0 g of Fe2O3.
_____ MgO(s) + _____ Fe(s) → _____ Fe2O3(s) + _____ Mg(s)

Answer:

3MgO(s) + 2Fe(s) → Fe2O3(s) + 3Mg(s)

According to the equation, the number of the moles of MgO and Fe2O3 relate as 3/1:

$$\frac{n(MgO)}{3} = n(Fe_2O_3)$$

The number of grams is proportional to the number of moles with the factor of molar mass:

$$\frac{m(MgO)}{M(MgO)} = n(MgO), \qquad \frac{m(Fe_2O_3)}{M(Fe_2O_3)} = n(Fe_2O_3).$$

Molar mass of MgO is 40.3044 g/mol, molar mass of Fe_2O_3 is 159.69 g/mol. Then, we can derive the expression for the mass of MgO:

$$m(MgO) = n(MgO) * M(MgO) = n(Fe_2O_3) * M(MgO) * 3 = \frac{m(Fe_2O_3)}{M(Fe_2O_3)} * M(MgO) * 3$$

$$m(MgO) = \frac{20.0}{159.69} * 40.3044 * 3 = 15.14\ g$$