Answer on Question #55664 - Chemistry – General chemistry

Question

For each of the following reactions, calculate the grams of indicated product when 16.9 g of the first reactant and 10.4 g of the second reactant is used:

$Fe_2O_3(s) + 3H_2(g) \rightarrow 2Fe(s) + 3H_2O(l)$ (H_2O)

Answer:

Number of moles of the reactants are:

$$n(Fe_2O_3) = \frac{m(Fe_2O_3)}{M(Fe_2O_3)} = \frac{16.9}{159.69} = 0.106\ mol$$

$$n(H_2) = \frac{m(H_2)}{M(H_2)} = \frac{10.4}{2.016} = 5.159\ mol$$

Then we make a proportion:

1 mole of Fe_2O_3 reacts with 3 moles of H_2

0.106 moles of Fe_2O_3 – *x* moles of H_2

$$x = \frac{0.106 \cdot 3}{1} = 0.318\ moles\ of\ H_2\ should\ react\ with\ 0.106\ moles\ of\ Fe_2O_3$$

There are 5.159 moles of hydrogen – it's too much, therefore Fe_2O_3 is the limiting reactant.

We need to make another proportion to calculate the mass of H_2O formed:

1 mole of Fe_2O_3 produces 3 moles of H_2O

0.106 moles of Fe_2O_3 – *x* moles of H_2O

$$x = \frac{0.106 \cdot 3}{3} = 0.106\ moles\ of\ H_2O\ is\ formed$$

The mass of H_2O is:

$$m(H_2O) = n(H_2O) \cdot M(H_2O) = 0.106 \cdot 18 = 0.848\ g$$

Answer: 0.848 g of H_2O