Answer on Question #43922 - Chemistry - Inorganic Chemistry
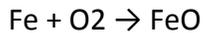
Question:

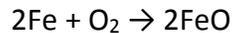For the reaction in Problem 5.051, shown below unbalanced:

Fe + O2 → FeO

how many grams of Fe are required to react completely with 4.40 x 10-3 mol of O2?

how many grams of FeO are produced from the complete reaction of 17.91 g of Fe?

Answer:

Balanced reaction:

$$2Fe + O_2 \rightarrow 2FeO$$

Number of moles of iron reacting with oxygen is twice as big as that of oxygen. So, number of moles of Fe completely reacted with O_2 is:

$$n(Fe) = 2n(O_2) = 2 \cdot 4.40 \cdot 10^{-3} = 8.80 \cdot 10^{-3} mol$$

Mass of Fe required to react completely with 4.40 x 10-3 mol of O_2 equals:

$$m(Fe) = n(Fe) \cdot M(Fe) = 8.80 \cdot 10^{-3} \cdot 55.8 = 0.491 \ g$$

Number of moles of iron in 17.91 g of Fe is:

$$n(Fe) = \frac{m(Fe)}{M(Fe)} = \frac{17.91}{55.8} = 0.321 mol$$

Number of moles of FeO produced is equal to number of moles of Fe reacted. So, 0.321 mol of FeO are produced.

Mass of FeO produced from the complete reaction of 17.91 g of Fe equals:

$$m(FeO) = n(FeO) \cdot M(FeO) = 0.321 \cdot 71.8 = 23.05 \ g$$

Answer: 0.491 g of Fe; 23.05 g of FeO.