Question

$NO_2 + H_2O \rightarrow HNO_3 + NO$

How many grams of nitrogen dioxide are required in this reaction to produce 5.00 g HNO_3?

Solution

Molar mass of NO_2: $M(NO_2) = 46.01$ g/mol

Molar mass of HNO_3: $M(HNO_3) = 63.01$ g/mol

Balanced chemical equation is

$$3\ NO_2 + H_2O \rightarrow 2\ HNO_3 + NO$$

As is clear from the balanced chemical equation, 3 mol of NO_2 are required to produce 2 mol of HNO_3. Thus, we can write the proportion

$2 \cdot M(HNO_3) - 3 \cdot M(NO_2)$

  $m(HNO_3) - m(NO_2)$

$m(NO_2) = 3 \cdot M(NO_2) \cdot m(HNO_3) / 2 \cdot M(HNO_3) = 3 \cdot 46.01 \cdot 5.00 / 2 \cdot 63.0 = 5.48$ g

Answer: 5.48 g of nitrogen dioxide are required to produce 5.00 g HNO_3