

$\text{Fe}(\text{NO}_3)_3$ (aq) + Na_3PO_4 (aq) \longrightarrow FePO_4 + 3NaNO_3 (aq)
assuming a percentage yield of 90 percent, what mass of ferric nitrate must be reacted with an excess of sodium phosphate to produce 54 g of ferric phosphate? The MWs are $\text{Fe}(\text{NO}_3)_3 = 242$ g, and FePO_4 is 151 g.

Solution. We find the amount of iron phosphate: $n(\text{FePO}_4) = \frac{m(\text{FePO}_4)}{M(\text{FePO}_4)}$, where $m(\text{FePO}_4)$ - mass of iron phosphate, g; $M(\text{FePO}_4)$ - molar weight of iron phosphate, g/mol. Then $n(\text{FePO}_4) = \frac{54}{151} = 0.36$ mol. By the reaction equation at 100% reaction yield $n(\text{FePO}_4) = n(\text{Fe}(\text{NO}_3)_3)$. In this case, we have a yield of 90%, then $n(\text{Fe}(\text{NO}_3)_3) = \frac{n(\text{FePO}_4)}{0.9} = \frac{0.36}{0.9} = 0.4$ mol. The mass of iron nitrate is calculated as: $m(\text{Fe}(\text{NO}_3)_3) = n(\text{Fe}(\text{NO}_3)_3) \times M(\text{Fe}(\text{NO}_3)_3) = 0.4 \times 242 = 96.8$ g.

Answer: 96.8 g.

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