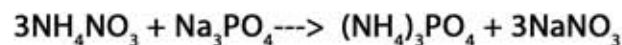


30 grams of ammonium nitrate reacts with 50 grams of sodium phosphate

a) Write the balanced reaction.

- 1 Identify cations/anions
2. Form compounds balancing ions using subscripts.
3. Identify reacton and write products.
4. Write balanced product comopounds using subscripts.
5. Balance reaction using coefficients.

Balanced Reaction:



Molar Masses: $\text{NH}_4\text{NO}_3 = 80.052 \text{ g/mol}$ $(\text{NH}_4)_3\text{PO}_4 = 149.09 \text{ g/mol}$
 $\text{Na}_3\text{PO}_4 = 163.94 \text{ g/mol}$ $\text{NaNO}_3 = 84.99 \text{ g/mol}$

b) Which of the reagents is the limiting reagent?

- 1 Pick a product to investigate.
- 2 Complete dimensional analysis for each of the given reagents (reactants)
- 3 Identify limiting reagent based on least amount of product produced.

$$\frac{30 \text{ g NH}_4\text{NO}_3}{80.05 \text{ g NH}_4\text{NO}_3} \times \frac{1 \text{ mol NH}_4\text{NO}_3}{3 \text{ mol NH}_4\text{NO}_3} \times \frac{2 \text{ mol NaNO}_3}{1 \text{ mol NaNO}_3} \times \frac{84.99 \text{ g NaNO}_3}{1 \text{ mol NaNO}_3} = 21.23 \text{ g NaNO}_3 \leftarrow \text{Limiting Reagent}$$

$$\frac{50 \text{ g Na}_3\text{PO}_4}{163.94 \text{ g Na}_3\text{PO}_4} \times \frac{1 \text{ mol Na}_3\text{PO}_4}{3 \text{ mol Na}_3\text{PO}_4} \times \frac{2 \text{ mol NaNO}_3}{1 \text{ mol NaNO}_3} \times \frac{84.99 \text{ g NaNO}_3}{1 \text{ mol NaNO}_3} = 44.31 \text{ g NaNO}_3$$

c) What is the maximum amount of each product that can be formed?

- 1 First product already determined in b: **21.23g NaNO₃**
- 2 Use limiting reagent to identify quantity in second product.

$$\frac{30 \text{ g NH}_4\text{NO}_3}{80.05 \text{ g NH}_4\text{NO}_3} \times \frac{1 \text{ mol NH}_4\text{NO}_3}{3 \text{ mol NH}_4\text{NO}_3} \times \frac{1 \text{ mol (NH}_4)_3\text{PO}_4}{1 \text{ mol (NH}_4)_3\text{PO}_4} \times \frac{149.09 \text{ g (NH}_4)_3\text{PO}_4}{1 \text{ mol (NH}_4)_3\text{PO}_4} = 18.62 \text{ g (NH}_4)_3\text{PO}_4$$

d) How much excess reagent is left over after the reaction is complete?

- 1 Calculate the amount of excess reagent needed from limiting reagent.
- 2 Subtract value found in d1 from value found in a1 for the excess reagent.

$$\frac{30 \text{ g NH}_4\text{NO}_3}{80.05 \text{ g NH}_4\text{NO}_3} \times \frac{1 \text{ mol NH}_4\text{NO}_3}{3 \text{ mol NH}_4\text{NO}_3} \times \frac{1 \text{ mol Na}_3\text{PO}_4}{1 \text{ mol Na}_3\text{PO}_4} \times \frac{163.94 \text{ g Na}_3\text{PO}_4}{1 \text{ mol Na}_3\text{PO}_4} = 20.48 \text{ g Na}_3\text{PO}_4$$

$$50 \text{ g Na}_3\text{PO}_4 - 20.48 \text{ g Na}_3\text{PO}_4 = 29.52 \text{ g Na}_3\text{PO}_4$$