

Worksheet 3: Extra Practice Problems

1. How many grams of sodium phosphate are required to react completely with 4.6 mol of calcium nitrate to form sodium nitrate and calcium phosphate?

- A) 7.5×10^2 g
 B) 3.6×10^2 g
 C) 2.5×10^2 g
 D) 5.0×10^2 g
 E) none of these



4.6 mol $\text{Ca}(\text{NO}_3)_2$	2 mol Na_3PO_4	163.94 g Na_3PO_4	= 5.0×10^2 g Na_3PO_4
	3 mol $\text{Ca}(\text{NO}_3)_2$	1 mol Na_3PO_4	

2. Consider the following reaction



If a container were to have 10 molecules of O_2 and 10 molecules of NH_3 initially, how many total molecules would be present in the container after this reaction goes to completion?

- A) 8 molecules
 B) 10 molecules
 C) 22 molecules
 D) 19 molecules
 E) 2 molecules

Determine limiting reactant based on NO production

$$\frac{10 \text{ O}_2}{5 \text{ O}_2} \bigg| \frac{4 \text{ NO}}{4 \text{ NH}_3} = \underline{\underline{8 \text{ NO}}} \leftarrow \text{O}_2 \text{ is L.R.}$$

$$\frac{10 \text{ NH}_3}{4 \text{ NH}_3} \bigg| \frac{4 \text{ NO}}{4 \text{ NH}_3} = 10 \text{ NO}$$

Determine how much H_2O produced

$$\frac{10 \text{ O}_2}{5 \text{ O}_2} \bigg| \frac{6 \text{ H}_2\text{O}}{5 \text{ O}_2} = \underline{\underline{12 \text{ H}_2\text{O}}}$$

$$\begin{array}{r} 8 \text{ NO} \\ + 12 \text{ H}_2\text{O} \\ + 2 \text{ NH}_3 \\ + \cancel{10 \text{ O}_2} \\ \hline 22 \text{ molecules} \end{array}$$

Determine how much NH_3 is unused

$$\frac{10 \text{ O}_2}{5 \text{ O}_2} \bigg| \frac{4 \text{ NH}_3}{4 \text{ NH}_3} = 8 \text{ NH}_3 \text{ used up} \therefore \frac{10}{8} \text{ NH}_3 \text{ remains}$$

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3. Sulfuric acid may be produced by the following three-step process (states-of-matter omitted):



How many moles of H_2SO_4 can be produced from 3.50 mol of FeS_2 ?

- A) 14.0 mol
B) 3.50 mol
C) 0.875 mol
D) 7.00 mol
E) 1.75 mol

3.50 mol FeS_2	8 mol SO_2	2 mol SO_3	1 mol H_2SO_4
	4 mol FeS_2	2 mol SO_2	1 mol SO_3

$= 7.00 \text{ mol } \text{H}_2\text{SO}_4$

4. When 95.4 g of barium and 20.8 g of nitrogen gas undergo a reaction that has a 89.0% yield, what mass of barium nitride forms?

- A) 326 g
B) 90.7 g
C) 102 g
D) 290. g
E) none of the above

$$\% \text{ yield} = \frac{\text{actual}}{\text{theoretical}} \times 100\%$$

$$0.890 = \frac{\text{actual}}{\text{theoretical}} \Rightarrow \text{actual} = 0.890 \times (\text{theoretical})$$



95.4 g Ba	1 mol Ba	1 mol Ba_3N_2	439.92 g Ba_3N_2
	137.3 g Ba	3 mol Ba	1 mol Ba_3N_2

$= 101.89 \text{ g } \text{Ba}_3\text{N}_2$ ← theoretical yield (Ba is L.R.)

20.8 g N_2	1 mol N_2	1 mol Ba_3N_2	439.92 g Ba_3N_2
	28.02 g N_2	1 mol N_2	1 mol Ba_3N_2

$= 326.56 \text{ g } \text{Ba}_3\text{N}_2$

$$\text{actual} = 0.890 (101.89 \text{ g } \text{Ba}_3\text{N}_2) = 90.68 \text{ g } \text{Ba}_3\text{N}_2 \Rightarrow \boxed{90.7 \text{ g}}$$