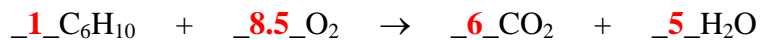


Problem Set - Limiting Reagents & Molar Yields - Answers

1. 12 moles of  $C_6H_{10}$  were reacted with 52 moles of Oxygen. Identify the limiting reagents and then predict the yield of the products in moles.



**12 moles**            **52 moles**

**Note: There are only 2 Significant Figures for this data]**

12 moles of  $C_6H_{10}$  would require  $12 \times 8.5 = 102$  moles of  $O_2$ , therefore there is not enough  $O_2$ .

$C_6H_{10}$  is in **Excess**

$O_2$  is the Limiting Reagent



$$n_{C_6H_{10}} = 1/8.5 \times 52 \text{ moles}$$

$$n_{C_6H_{10}} = \cancel{6.1176471} \text{ moles} = \mathbf{6.1 \text{ moles}}$$

$$n_{CO_2} = 6/8.5 \times 52 \text{ moles}$$

$$n_{CO_2} = \cancel{36.705882} \text{ moles} = \mathbf{37 \text{ moles}}$$

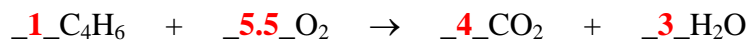
$$n_{H_2O} = 5/8.5 \times 52 \text{ moles}$$

$$n_{H_2O} = \cancel{30.588235} \text{ moles} = \mathbf{31 \text{ moles}}$$

**[Note: Only 2 Significant Figures are allowed for this answer]**

Problem Set - Limiting Reagents & Molar Yields - Answers

2. 0.4 moles of C<sub>4</sub>H<sub>6</sub> were reacted with 12 moles of Oxygen. Identify the limiting reagents and then predict the yield of the products in moles.



**0.4 moles**                      **12 moles**

**Note: There are only 1 Significant Figures for this data]**

0.4 moles of C<sub>4</sub>H<sub>6</sub> would require  $0.4 \times 5.5 = 2.2$  moles of O<sub>2</sub>, therefore there is excess O<sub>2</sub>.

C<sub>4</sub>H<sub>6</sub> is the Limiting Reagent

O<sub>2</sub> is in **Excess**



$$n_{\text{O}_2} = 5.5/1 \times 0.4 \text{ moles}$$

$$n_{\text{O}_2} = \underline{\quad 2.2 \quad} \text{ moles} = \underline{\quad 2 \text{ moles} \quad}$$

$$n_{\text{CO}_2} = 4/1 \times 0.4 \text{ moles}$$

$$n_{\text{CO}_2} = \underline{\quad 1.6 \quad} \text{ moles} = \underline{\quad 2 \text{ moles} \quad}$$

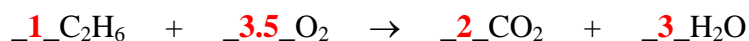
$$n_{\text{H}_2\text{O}} = 3/1 \times 0.4 \text{ moles}$$

$$n_{\text{H}_2\text{O}} = \underline{\quad 1.2 \quad} \text{ moles} = \underline{\quad 1 \text{ moles} \quad}$$

**[Note: Only 1 Significant Figures are allowed for this answer]**

Problem Set - Limiting Reagents & Molar Yields - Answers

3. 12 moles of  $C_2H_6$  were reacted with 0.50 moles of Oxygen. Identify the limiting reagents and then predict the yield of the products in moles.



**12 moles**                      **0.50 moles**

**Note: There are only 2 Significant Figures for this data]**

12 moles of  $C_2H_6$  would require  $12 \times 3.5 = 42$  moles of  $O_2$ , therefore there is excess  $C_2H_6$ .

$C_2H_6$  is in **Excess**

$O_2$  is the **Limiting Reagent**



$$n_{C_2H_6} = 1/3.5 \times 0.50 \text{ moles}$$

$$n_{C_2H_6} = \cancel{0.1428571} \text{ moles} = \mathbf{0.14 \text{ moles}}$$

$$n_{CO_2} = 2/3.5 \times 0.50 \text{ moles}$$

$$n_{CO_2} = \cancel{0.2857142} \text{ moles} = \mathbf{0.29 \text{ moles}}$$

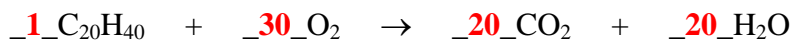
$$n_{H_2O} = 3/3.5 \times 0.50 \text{ moles}$$

$$n_{H_2O} = \cancel{0.4285714} \text{ moles} = \mathbf{0.43 \text{ moles}}$$

**[Note: Only 2 Significant Figures are allowed for this answer]**

Problem Set - Limiting Reagents & Molar Yields - Answers

4. 5.00 moles of C<sub>20</sub>H<sub>40</sub> were reacted with 5.00 moles of Oxygen. Identify the limiting reagents and then predict the yield of the products in moles.



**5.00 moles**            **5.00 moles**

**Note: There are only 3 Significant Figures for this data]**

5.00 moles of C<sub>20</sub>H<sub>40</sub> would require 5 x 30 = 150 moles of O<sub>2</sub>, therefore there is excess C<sub>20</sub>H<sub>40</sub>.

C<sub>20</sub>H<sub>40</sub> is in **Excess**

O<sub>2</sub> is the Limiting Reagent



$$n_{\text{C}_{20}\text{H}_{40}} = 1/30 \times 5.00 \text{ moles}$$

$$n_{\text{C}_{20}\text{H}_{40}} = \del{0.1666666} \text{ moles} = \mathbf{0.167 \text{ moles}}$$

$$n_{\text{CO}_2} = 20/30 \times 5.00 \text{ moles}$$

$$n_{\text{CO}_2} = \del{3.33333333} \text{ moles} = \mathbf{3.33 \text{ moles}}$$

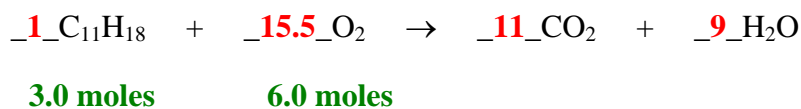
$$n_{\text{H}_2\text{O}} = 20/30 \times 5.00 \text{ moles}$$

$$n_{\text{H}_2\text{O}} = \del{3.33333333} \text{ moles} = \mathbf{3.33 \text{ moles}}$$

**[Note: Only 3 Significant Figures are allowed for this answer]**

Problem Set - Limiting Reagents & Molar Yields - Answers

5. 3.0 moles of  $C_{11}H_{18}$  were reacted with 6.0 moles of Oxygen. Identify the limiting reagents and then predict the yield of the products in moles.



**Note: There are only 2 Significant Figures for this data]**

3.0 moles of  $C_{11}H_{18}$  would require  $3.0 \times 15.5 = 46.5$  moles of  $O_2$ , therefore there is excess  $C_{11}H_{18}$ .

$C_{11}H_{18}$  is in **Excess**

$O_2$  is the Limiting Reagent



$$n_{C_{11}H_{18}} = 1/15.5 \times 6.0 \text{ moles}$$

$$n_{C_{11}H_{18}} = 0.3870967 \text{ moles} = \mathbf{0.39 \text{ moles}}$$

$$n_{CO_2} = 11/15.5 \times 6.0 \text{ moles}$$

$$n_{CO_2} = 4.2580645 \text{ moles} = \mathbf{4.3 \text{ moles}}$$

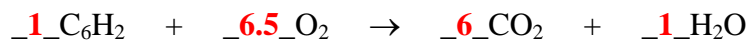
$$n_{H_2O} = 9/15.5 \times 6.0 \text{ moles}$$

$$n_{H_2O} = 3.483871 \text{ moles} = \mathbf{3.5 \text{ moles}}$$

**[Note: Only 2 Significant Figures are allowed for this answer]**

Problem Set - Limiting Reagents & Molar Yields - Answers

6. 0.21 moles of  $C_6H_2$  were reacted with 0.32 moles of Oxygen. Identify the limiting reagents and then predict the yield of the products in moles.



**0.21 moles**            **0.32 moles**

**Note: There are only 2 Significant Figures for this data]**

0.21 moles of  $C_6H_2$  would require  $0.21 \times 6.5 = 1.365$  moles of  $O_2$ , therefore there is excess  $C_6H_2$ .

$C_6H_2$  is in **Excess**

$O_2$  is the **Limiting Reagent**



$$n_{C_6H_2} = 1/6.5 \times 0.32 \text{ moles}$$

$$n_{C_6H_2} = \underline{0.0492307} \text{ moles} = \underline{0.049} \text{ moles}$$

$$n_{CO_2} = 6/6.5 \times 0.32 \text{ moles}$$

$$n_{CO_2} = \underline{0.2953846} \text{ moles} = \underline{0.30} \text{ moles}$$

$$n_{H_2O} = 1/6.5 \times 0.32 \text{ moles}$$

$$n_{H_2O} = \underline{0.0492307} \text{ moles} = \underline{0.049} \text{ moles}$$

**[Note: Only 2 Significant Figures are allowed for this answer]**

Problem Set - Limiting Reagents & Molar Yields - Answers

7. 12 moles of  $C_8H_8$  were reacted with 52 moles of HCl. Identify the limiting reagents and then predict the yield of the products in moles.



**12 moles**                      **52 moles**

**Note: There are only 2 Significant Figures for this data]**

12 moles of  $C_8H_8$  would require  $12 \times 4 = 48$  moles of HCl (which there is), therefore there is excess HCl.

HCl is in **Excess**

$C_8H_8$  is the **Limiting Reagent**



$$n_{HCl} = 4/1 \times 12 \text{ moles}$$

$$n_{HCl} = \mathbf{48 \text{ moles}}$$

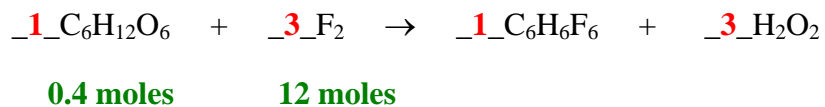
$$n_{C_8H_{12}Cl_4} = 1/1 \times 12 \text{ moles}$$

$$n_{C_8H_{12}Cl_4} = \mathbf{12 \text{ moles}}$$

**[Note: Only 2 Significant Figures are allowed for this answer]**

Problem Set - Limiting Reagents & Molar Yields - Answers

8. 0.4 moles of  $C_6H_{12}O_6$  were reacted with 12 moles of  $F_2$ . Identify the limiting reagents and then predict the yield of the products in moles.



**Note: There are only 1 Significant Figures for this data]**

0.4 moles of  $C_6H_{12}O_6$  would require  $3 \times 0.4 = 1.2$  moles of  $F_2$  (which there is), therefore there is excess  $F_2$ .

$F_2$  is in **Excess**

$C_6H_{12}O_6$  is the **Limiting Reagent**



$$n_{F_2} = 3/1 \times 0.4 \text{ moles}$$

$$n_{F_2} = \underline{1.2} \text{ moles} = \underline{1 \text{ mole}}$$

$$n_{C_6H_6F_6} = 1/1 \times 0.4 \text{ moles}$$

$$n_{C_6H_6F_6} = \underline{0.4 \text{ moles}}$$

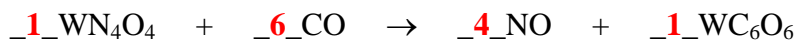
$$n_{H_2O_2} = 3/1 \times 0.4 \text{ moles}$$

$$n_{H_2O_2} = \underline{1.2} \text{ moles} = \underline{1 \text{ mole}}$$

**[Note: Only 1 Significant Figures are allowed for this answer]**

Problem Set - Limiting Reagents & Molar Yields - Answers

9. 12 moles of  $\text{WN}_4\text{O}_4$  were reacted with 0.50 moles of CO. Identify the limiting reagents and then predict the yield of the products in moles.



**12 moles**                      **0.50 moles**

**Note: There are only 2 Significant Figures for this data]**

12 moles of  $\text{WN}_4\text{O}_4$  would require  $12 \times 6 = 72$  moles of CO (which there isn't), therefore there is excess  $\text{WN}_4\text{O}_4$ .

$\text{WN}_4\text{O}_4$  is in **Excess**

**CO is the Limiting Reagent**



$$n_{\text{WN}_4\text{O}_4} = 1/6 \times 0.50 \text{ moles}$$

$$n_{\text{WN}_4\text{O}_4} = \cancel{0.0833333} \text{ moles} = \mathbf{0.083 \text{ moles}}$$

$$n_{\text{NO}} = 4/6 \times 0.5 \text{ moles}$$

$$n_{\text{NO}} = \cancel{0.3333333} \text{ moles} = \mathbf{0.33 \text{ moles}}$$

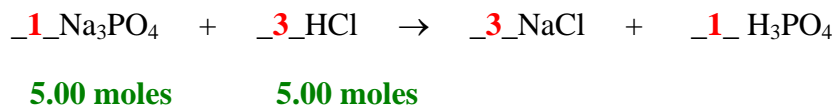
$$n_{\text{WC}_6\text{O}_6} = 1/6 \times 0.50 \text{ moles}$$

$$n_{\text{WC}_6\text{O}_6} = \cancel{0.0833333} \text{ moles} = \mathbf{0.083 \text{ moles}}$$

**[Note: Only 2 Significant Figures are allowed for this answer]**

Problem Set - Limiting Reagents & Molar Yields - Answers

10. 5.00 moles of  $\text{Na}_3\text{PO}_4$  were reacted with 5.00 moles of  $\text{HCl}$ . Identify the limiting reagents and then predict the yield of the products in moles.



**Note: There are only 3 Significant Figures for this data]**

5 moles of  $\text{Na}_3\text{PO}_4$  would require  $5 \times 3 = 15$  moles of  $\text{HCl}$  (which there isn't), therefore there is excess  $\text{Na}_3\text{PO}_4$ .

$\text{Na}_3\text{PO}_4$  is in **Excess**

**HCl is the Limiting Reagent**



$$n_{\text{Na}_3\text{PO}_4} = 1/3 \times 5.00 \text{ moles}$$

$$n_{\text{Na}_3\text{PO}_4} = \underline{1.6666667}\text{-moles} = \underline{1.67 \text{ moles}}$$

$$n_{\text{NaCl}} = 3/3 \times 5.00 \text{ moles}$$

$$n_{\text{NaCl}} = \underline{5.00 \text{ moles}}$$

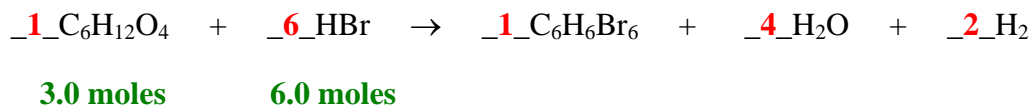
$$n_{\text{H}_3\text{PO}_4} = 1/3 \times 5.00 \text{ moles}$$

$$n_{\text{H}_3\text{PO}_4} = \underline{1.6666667}\text{-moles} = \underline{1.67 \text{ moles}}$$

**[Note: Only 3 Significant Figures are allowed for this answer]**

Problem Set - Limiting Reagents & Molar Yields - Answers

11. 3.0 moles of  $C_6H_{12}O_4$  were reacted with 6.0 moles of HBr. Identify the limiting reagents and then predict the yield of the products in moles.



**Note: There are only 2 Significant Figures for this data]**

3.0 moles of  $C_6H_{12}O_4$  would require  $6 \times 3.0 = 18$  moles of HBr (which there isn't), therefore there is excess  $C_6H_{12}O_4$ .

$C_6H_{12}O_4$  is in **Excess**

**HBr is the Limiting Reagent**



$$n_{C_6H_{12}O_4} = 1/6 \times 6.0 \text{ moles}$$

$$n_{C_6H_{12}O_4} = \underline{1.0 \text{ moles}}$$

$$n_{C_6H_6Br_6} = 1/6 \times 6.0 \text{ moles}$$

$$n_{C_6H_6Br_6} = \underline{1.0 \text{ moles}}$$

$$n_{H_2O} = 4/6 \times 6.0 \text{ moles}$$

$$n_{H_2O} = \underline{4.0 \text{ moles}}$$

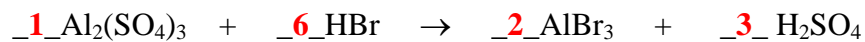
$$n_{H_2} = 2/6 \times 6.0 \text{ moles}$$

$$n_{H_2} = \underline{2.0 \text{ moles}}$$

**[Note: Only 2 Significant Figures are allowed for this answer]**

Problem Set - Limiting Reagents & Molar Yields - Answers

12. 0.21 moles of  $\text{Al}_2(\text{SO}_4)_3$  were reacted with 0.32 moles of HBr. Identify the limiting reagents and then predict the yield of the products in moles.



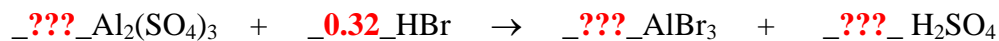
**0.21 moles**      **0.32 moles**

**Note: There are only 2 Significant Figures for this data]**

0.21 moles of  $\text{Al}_2(\text{SO}_4)_3$  would require  $0.21 \times 6 = 1.26$  moles of HBr (which there isn't), therefore there is excess  $\text{Al}_2(\text{SO}_4)_3$ .

$\text{Al}_2(\text{SO}_4)_3$  is in **Excess**

**HBr is the Limiting Reagent**



$$n_{\text{Al}_2(\text{SO}_4)_3} = 1/6 \times 0.32 \text{ moles}$$

$$n_{\text{Al}_2(\text{SO}_4)_3} = 0.05333333\text{-moles} = \mathbf{0.053 \text{ moles}}$$

$$n_{\text{AlBr}_3} = 2/6 \times 0.32 \text{ moles}$$

$$n_{\text{AlBr}_3} = 0.106666\text{-moles} = \mathbf{0.11 \text{ moles}}$$

$$n_{\text{H}_2\text{SO}_4} = 3/6 \times 0.32 \text{ moles}$$

$$n_{\text{H}_2\text{SO}_4} = \mathbf{0.16 \text{ moles}}$$

**[Note: Only 2 Significant Figures are allowed for this answer]**