

Molar Yields - Problem Set #1 - Answers

Major Steps in Determining Molar Yields:

- 1) Balance the Equation in Moles.
- 2) Write out the **Number of Moles, n** , of all species where this data is given.
- 3) Calculate the required **Number of Moles, n** , for the species in question.

Note #1: Show all work for all questions.

Note #2: Use the number of significant figures in your final answer that is justified by the number of significant figures of the data you were given.

Determine the number of moles of the indicated products and/or starting materials as requested:¹

1. The combustion of 1.2 moles of C_4H_8 produces how many moles of water.



$$n_{C_4H_8} = 1.2 \text{ moles}$$

$$n_{H_2O} = ???$$

$$n_{H_2O} = 4 \times n_{C_4H_8}$$

$$\underline{n_{H_2O} = 4 \times 1.2 \text{ mole} = 4.8 \text{ moles}}$$

-
2. When 0.024 moles of HF are reacted as follows, how many moles of $C_2H_4F_2$ are produced?



$$n_{HF} = 0.024 \text{ moles}$$

$$n_{C_2H_4F_2} = ???$$

$$n_{C_2H_4F_2} = 0.5 \times n_{HF}$$

$$\underline{n_{C_2H_4F_2} = 0.5 \times 0.024 \text{ moles} = 0.012 \text{ moles}}$$

¹ Note: The work & answers are shown in Red and/or Blue.

Molar Yields - Problem Set #1 - Answers

-
3. If a person burns 0.24 moles of C_9H_{20} , how many moles of CO_2 will be produced?



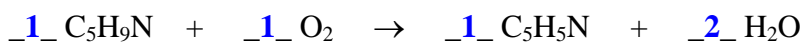
$$n_{C_9H_{20}} = 0.24 \text{ moles}$$

$$n_{CO_2} = ???$$

$$n_{CO_2} = 9 \times n_{C_9H_{20}}$$

$$\underline{n_{CO_2}} = 9 \times 0.24 \text{ moles} = \underline{2.16 \text{ moles}} = \underline{2.2 \text{ moles}}$$

-
4. When the following reaction consumes 234 moles of oxygen, how many moles of C_5H_5N are produced?



$$n_{O_2} = 234 \text{ moles}$$

$$n_{C_5H_5N} = ???$$

$$\underline{n_{C_5H_5N}} = 1 \times n_{O_2} = \underline{234 \text{ moles}}$$

-
5. How many moles of oxygen does it take to burn 1.6 moles of C_2H_4 ?



$$n_{C_2H_4} = 1.6 \text{ moles}$$

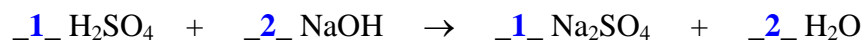
$$n_{O_2} = ???$$

$$n_{O_2} = 3 \times n_{C_2H_4}$$

$$\underline{n_{O_2}} = 3 \times 1.6 \text{ moles} = \underline{4.8 \text{ moles}}$$

Molar Yields - Problem Set #1 - Answers

6. How many moles of NaOH are consumed in the following reaction to produce 0.22 moles of Na₂SO₄?



$$n_{\text{Na}_2\text{SO}_4} = 0.22 \text{ moles}$$

$$n_{\text{NaOH}} = ???$$

$$n_{\text{NaOH}} = 2 \times n_{\text{Na}_2\text{SO}_4}$$

$$\underline{n_{\text{NaOH}}} = 2 \times 0.22 \text{ moles} = \underline{0.44 \text{ moles}}$$

7. How many moles of C₆H₆ have to be burned to produce 6.06 moles of CO₂.



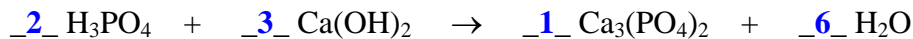
$$n_{\text{CO}_2} = 6.06 \text{ moles}$$

$$n_{\text{C}_6\text{H}_6} = ???$$

$$n_{\text{C}_6\text{H}_6} = 1/6 \times n_{\text{CO}_2}$$

$$\underline{n_{\text{C}_6\text{H}_6}} = 1/6 \times 6.06 \text{ moles} = \underline{1.01 \text{ moles}}$$

8. If one wants to produce 17 moles of Ca₃(PO₄)₂, how many moles of H₃PO₄ should one use?



$$n_{\text{Ca}_3(\text{PO}_4)_2} = 17 \text{ moles}$$

$$n_{\text{H}_3\text{PO}_4} = ???$$

$$n_{\text{H}_3\text{PO}_4} = 2 \times n_{\text{Ca}_3(\text{PO}_4)_2}$$

$$\underline{n_{\text{H}_3\text{PO}_4}} = 2 \times 17 \text{ moles} = \underline{34 \text{ moles}}$$

Molar Yields - Problem Set #1 - Answers

-
9. The burning of 1.2 moles of C_4H_8 produces how many moles of CO_2 .



$$n_{C_4H_8} = 1.2 \text{ moles}$$

$$n_{CO_2} = ???$$

$$n_{CO_2} = 4 \times n_{C_4H_8}$$

$$\underline{n_{CO_2}} = 4 \times 1.2 \text{ moles} = \underline{4.8 \text{ moles}}$$

-
10. When 0.024 moles of C_6H_6 are reacted as follows, how many moles of HF are consumed?



$$n_{C_6H_6} = 0.024 \text{ moles}$$

$$n_{HF} = ???$$

$$n_{HF} = 3 \times n_{C_6H_6}$$

$$\underline{n_{HF}} = 3 \times 0.024 \text{ moles} = \underline{0.072 \text{ moles}}$$

-
11. If a person combusts 0.24 moles of C_9H_{20} , how many moles of water will be produced?



$$n_{C_9H_{20}} = 0.24 \text{ moles}$$

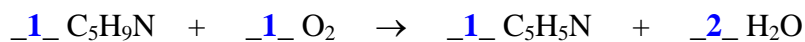
$$n_{H_2O} = ???$$

$$n_{H_2O} = 10 \times n_{C_9H_{20}}$$

$$\underline{n_{H_2O}} = 10 \times 0.24 \text{ moles} = \underline{2.4 \text{ moles}}$$

Molar Yields - Problem Set #1 - Answers

12. For the following reaction, how many moles of C₅H₉N must be consumed to produce 2.2 moles of water?



$$n_{\text{H}_2\text{O}} = 2.2 \text{ moles}$$

$$n_{\text{C}_5\text{H}_9\text{N}} = ???$$

$$n_{\text{C}_5\text{H}_9\text{N}} = 1/2 \times n_{\text{H}_2\text{O}}$$

$$\underline{n_{\text{C}_5\text{H}_9\text{N}} = 1/2 \times 2.2 \text{ moles} = \underline{1.1 \text{ moles}}}$$

13. How many moles of C₂H₄ does it take to consume 1.5 moles of oxygen in a combustion reaction?



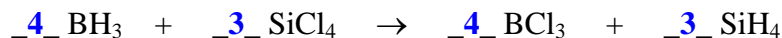
$$n_{\text{O}_2} = 1.5 \text{ moles}$$

$$n_{\text{C}_2\text{H}_4} = ???$$

$$n_{\text{C}_2\text{H}_4} = 1/3 \times n_{\text{O}_2}$$

$$\underline{n_{\text{C}_2\text{H}_4} = 1/3 \times 1.5 \text{ moles} = \underline{0.50 \text{ moles}}}$$

14. How many moles of BH₃ are consumed in the following reaction to produce 12 moles of SiH₄?



$$n_{\text{SiH}_4} = 12 \text{ moles}$$

$$n_{\text{BH}_3} = ???$$

$$n_{\text{BH}_3} = 4/3 \times n_{\text{SiH}_4}$$

$$\underline{n_{\text{BH}_3} = 4/3 \times 12 \text{ moles} = \underline{16 \text{ moles}}}$$

Molar Yields - Problem Set #1 - Answers

-
15. How many moles of C_6H_6 have to be burned to produce 6.00 moles of water.



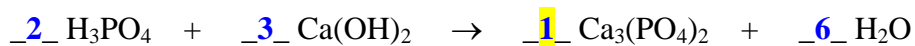
$$n_{H_2O} = 6.00 \text{ moles}$$

$$n_{C_6H_6} = ???$$

$$n_{C_6H_6} = 1/3 \times n_{H_2O}$$

$$\underline{n_{C_6H_6}} = 1/3 \times 6.00 \text{ moles} = \underline{2.00 \text{ moles}}$$

-
16. If this reaction produces 6.0 moles of $Ca_3(PO_4)_2$, how many moles of water would be produced?



$$n_{Ca_3(PO_4)_2} = 6.0 \text{ moles}$$

$$n_{H_2O} = ???$$

$$n_{H_2O} = 6 \times n_{Ca_3(PO_4)_2}$$

$$\underline{n_{H_2O}} = 6 \times 6.0 \text{ moles} = \underline{36.0 \text{ moles}} = \underline{36 \text{ moles}}$$