

Mass ↔ Mole Conversion - Problem Set #1 - Answers

Determine the Mass or number of moles for of the following molecules as required:^{1,2}

1. A samples of C_2H_5F weights 2.3 g, how many moles are present?

$$C \Rightarrow 12.01 \text{ g/mole} \quad \#C \equiv 2$$

$$H \Rightarrow 1.008 \text{ g/mole} \quad \#H \equiv 5$$

$$F \Rightarrow 19.00 \text{ g/mole} \quad \#F \equiv 1$$

$$MW = (2 \times C) + (5 \times H) + (1 \times F)$$

$$MW = (2 \times 12.01 \text{ g/mole}) + (5 \times 1.008 \text{ g/mole}) + (1 \times 19.00 \text{ g/mole})$$

$$MW = 48.06 \text{ g/mole} \Rightarrow 4.806 \times 10^1 \text{ g/mole}$$

$$W = 2.3 \text{ g}$$

$$n = ???$$

$$n = W / MW$$

$$n = 2.3 \text{ g} / 48.06 \text{ g/mole}$$

$$n = \cancel{0.0478568} \text{ moles} = \mathbf{4.8 \times 10^{-2} \text{ moles}}$$

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2. A samples of C_3H_5O contains 1.13×10^{-2} moles, what does it weight?

$$C \Rightarrow 12.01 \text{ g/mole} \quad \#C \equiv 3$$

$$H \Rightarrow 1.008 \text{ g/mole} \quad \#H \equiv 5$$

$$O \Rightarrow 16.00\text{g/mole} \quad \#O \equiv 1$$

$$MW = (3 \times C) + (5 \times H) + (1 \times O)$$

$$MW = (3 \times 12.01 \text{ g/mole}) + (5 \times 1.008 \text{ g/mole}) + (1 \times 16.00 \text{ g/mole})$$

$$MW = 57.07 \text{ g/mole} \Rightarrow 5.707 \times 10^1 \text{ g/mole}$$

$$W = ???$$

$$n = 1.13 \times 10^{-2} \text{ moles}$$

¹ Note: Use the Atomic Masses from the table on the inside front cover of the text book.

² Note: These are the same molecules used on the Molecular Weight and % Composition Problem Sets.

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$$W = MW \times n$$

$$W = 57.07 \text{ g/mole} \times 1.13 \times 10^{-2} \text{ moles} =$$

$$W = \cancel{0.644891} \text{ g}$$

$$W = \mathbf{6.45 \times 10^{-1} \text{ grams}}$$

3. $\text{C}_5\text{H}_5\text{N}$ - 22.3 g

$$\text{C} \Rightarrow 12.01 \text{ g/mole} \quad \#C \equiv 5$$

$$\text{H} \Rightarrow 1.008 \text{ g/mole} \quad \#H \equiv 5$$

$$\text{N} \Rightarrow 14.01 \text{ g/mole} \quad \#N \equiv 1$$

$$\text{MW} = (5 \times \text{C}) + (5 \times \text{H}) + (1 \times \text{N})$$

$$\text{MW} = (5 \times 12.01 \text{ g/mole}) + (5 \times 1.008 \text{ g/mole}) + (1 \times 14.01 \text{ g/mole})$$

$$\text{MW} = 79.10 \text{ g/mole} \Rightarrow 7.910 \times 10^1 \text{ g/mole}$$

$$W = 22.3 \text{ g}$$

$$n = ???$$

$$\mathbf{n = W / MW}$$

$$n = 22.3 \text{ g} / 79.10 \text{ g/mole}$$

$$n = \cancel{0.2819216} \text{ moles} = \mathbf{2.82 \times 10^{-1} \text{ moles}}$$
 (or 0.282 would be OK)

4. $\text{C}_6\text{H}_{12}\text{O}_6$ - 2.713×10^3 moles

$$\text{C} \Rightarrow 12.01 \text{ g/mole} \quad \#C \equiv 6$$

$$\text{H} \Rightarrow 1.008 \text{ g/mole} \quad \#H \equiv 12$$

$$\text{O} \Rightarrow 16.00 \text{ g/mole} \quad \#O \equiv 6$$

$$\text{MW} = (6 \times \text{C}) + (12 \times \text{H}) + (6 \times \text{O})$$

$$\text{MW} = (6 \times 12.01 \text{ g/mole}) + (12 \times 1.008 \text{ g/mole}) + (6 \times 16.00 \text{ g/mole})$$

$$\text{MW} = \cancel{180.156} \text{ g/mole} = 180.2 \text{ g/mole} \Rightarrow 1.802 \times 10^2 \text{ g/mole}$$

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$$W = ???$$

$$n = 2.713 \times 10^3$$

$$W = MW \times n$$

$$W = 180.156 \text{ g/mole} \times 2.713 \times 10^3 \text{ moles} =$$

$$W = 488,763.23 \text{ g}$$

$$W = \mathbf{4.888 \times 10^5 \text{ grams}}$$

5. NaCl - 34 Kg

$$\text{Na} \Rightarrow 22.99 \text{ g/mole} \quad \#\text{Na} \equiv 1$$

$$\text{Cl} \Rightarrow 35.45 \text{ g/mole} \quad \#\text{Cl} \equiv 1$$

$$MW = (1 \times \text{Na}) + (1 \times \text{Cl})$$

$$MW = (1 \times 22.99 \text{ g/mole}) + (1 \times 35.45 \text{ g/mole})$$

$$MW = 58.44 \text{ g/mole} \Rightarrow 5.844 \times 10^1 \text{ g/mole}$$

$$W = 34 \text{ Kg}$$

$$W = 34 \text{ Kg} \times 1,000 \text{ g/Kg} = 34,000 \text{ g}$$

$$n = ???$$

$$n = W / MW$$

$$n = 34,000 \text{ g} / 58.44 \text{ g/mole}$$

$$n = \del{581.79329} \text{ moles} = \mathbf{5.8 \times 10^2 \text{ moles}}$$

6. C₆CrO₆ - 0.0107 g

$$\text{C} \Rightarrow 12.01 \text{ g/mole} \quad \#\text{C} \equiv 6$$

$$\text{Cr} \Rightarrow 52.00 \text{ g/mole} \quad \#\text{Cr} \equiv 1$$

$$\text{O} \Rightarrow 16.00 \text{ g/mole} \quad \#\text{O} \equiv 6$$

$$MW = (6 \times \text{C}) + (1 \times \text{Cr}) + (6 \times \text{O})$$

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$$MW = (6 \times 12.01 \text{ g/mole}) + (1 \times 52.00 \text{ g/mole}) + (6 \times 16.00 \text{ g/mole})$$

$$MW = \cancel{220.06} \text{ g/mole} = 220.1 \text{ g/mole} \Rightarrow 2.201 \times 10^2 \text{ g/mole}$$

$$W = 0.0107 \text{ g}$$

$$n = ???$$

$$\mathbf{n = W / MW}$$

$$n = 0.0107 \text{ g} / 220.06 \text{ g/mole}$$

$$n = \cancel{4.86231 \times 10^{-5}} \text{ moles} = \mathbf{4.86 \times 10^{-5} \text{ moles}}$$

7. $\text{C}_{10}\text{H}_{10}\text{Fe}$ - 0.0107 moles

$$\text{C} \Rightarrow 12.01 \text{ g/mole} \quad \#C \equiv 10$$

$$\text{H} \Rightarrow 1.008 \text{ g/mole} \quad \#H \equiv 10$$

$$\text{Fe} \Rightarrow 55.85 \text{ g/mole} \quad \#\text{Fe} \equiv 1$$

$$MW = (10 \times C) + (10 \times H) + (1 \times \text{Fe})$$

$$MW = (10 \times 12.01 \text{ g/mole}) + (10 \times 1.008 \text{ g/mole}) + (1 \times 55.85 \text{ g/mole})$$

$$MW = \cancel{186.03} \text{ g/mole} = 186.0 \text{ g/mole} \Rightarrow 1.860 \times 10^2 \text{ g/mole}$$

$$W = ???$$

$$n = 0.0107 \text{ moles}$$

$$\mathbf{W = MW \times n}$$

$$W = 186.03 \text{ g/mole} \times 0.0107 \text{ moles} =$$

$$W = \cancel{1.990521} \text{ g}$$

$$W = \mathbf{1.99 \text{ grams}}$$

8. MgO - $2.3 \times 10^{-5} \text{ Kg}$

$$\text{Mg} \Rightarrow 24.31 \text{ g/mole} \quad \#\text{Mg} \equiv 1$$

$$\text{O} \Rightarrow 16.00 \text{ g/mole} \quad \#\text{O} \equiv 1$$

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$$MW = (1 \times Mg) + (1 \times O)$$

$$MW = (1 \times 24.31 \text{ g/mole}) + (1 \times 16.00 \text{ g/mole})$$

$$MW = 40.31 \text{ g/mole} \Rightarrow 4.031 \times 10^1 \text{ g/mole}$$

$$W = 2.3 \times 10^{-5} \text{ Kg}$$

$$W = 2.3 \times 10^{-5} \text{ Kg} \times 1,000 \text{ g/Kg} = 2.3 \times 10^{-2} \text{ g}$$

$$n = ???$$

$$n = W / MW$$

$$n = 2.3 \times 10^{-2} \text{ g} / 40.31 \text{ g/mole}$$

$$n = 5.70578 \times 10^{-4} \text{ moles}$$

$$n = \mathbf{5.7 \times 10^{-4} \text{ moles}}$$

9. Na_2SiO_3 - 0.19 moles

$$\text{Na} \Rightarrow 22.99 \text{ g/mole} \quad \#\text{Na} \equiv 2$$

$$\text{Si} \Rightarrow 28.09 \text{ g/mole} \quad \#\text{Si} \equiv 1$$

$$\text{O} \Rightarrow 16.00 \text{ g/mole} \quad \#\text{O} \equiv 3$$

$$MW = (2 \times \text{Na}) + (1 \times \text{Si}) + (3 \times \text{O})$$

$$MW = (2 \times 22.99 \text{ g/mole}) + (1 \times 28.09 \text{ g/mole}) + (3 \times 16.00 \text{ g/mole})$$

$$MW = \del{122.07} \text{ g/mole} = 122.1 \text{ g/mole} \Rightarrow 1.221 \times 10^2 \text{ g/mole}$$

$$W = ???$$

$$n = 0.19 \text{ moles}$$

$$W = MW \times n$$

$$W = 122.07 \text{ g/mole} \times 0.19 \text{ moles} =$$

$$W = \del{23.1933} \text{ g}$$

$$W = \mathbf{23 \text{ grams}}$$

10. A 23.1 g sample of Rock is found to be composed of 0.197 moles, what is the Molecular Weight?

$$W = 23.1 \text{ g}$$

$$n = 0.197 \text{ moles}$$

$$MW = ???$$

$$\mathbf{MW = W / n}$$

$$MW = 23.1 \text{ g} / 0.197 \text{ moles}$$

$$MW = ~~117.25888~~ \text{ g/mole}$$

$$MW = \mathbf{117 \text{ g/mole}}$$

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11. A bowl of a pharmaceutical product weights 1.2 g and was found to have 0.0078 moles in it. What was the molecular weight of the pharmaceutical?

$$W = 1.2 \text{ g}$$

$$n = 0.0078 \text{ moles}$$

$$MW = ???$$

$$\mathbf{MW = W / n}$$

$$MW = 1.2 \text{ g} / 0.0078 \text{ moles}$$

$$MW = ~~153.84615~~ \text{ g/mole}$$

$$MW = \mathbf{1.5 \times 10^2 \text{ g/mole}}$$