

Unit 6 Test Review

1. Put the following in scientific notation

.00456 =  $4.56 \times 10^{-2}$

54692 =  $5.4692 \times 10^4$

2. Calculate  $3.5 \times 10^5 \times 3.2 \times 10^{-3} = 1120$  or  $1.12 \times 10^3$

3.  $\frac{3.542 \times 10^5 \cdot 3.22 \times 10^{-3}}{2.50 \times 10^5 \cdot 5.00 \times 10^{-5}} = 91.2$  or  $9.12 \times 10^1$

4. What is the molar mass of  $(\text{NH}_4)_2\text{S}$ ?

N	2	x	14	=	28	} 68 g/mol
H	8	x	1	=	8	
S	1	x	32	=	32	

5. What is the molar mass of  $\text{Mg}(\text{C}_2\text{H}_3\text{O}_2)_2$ ?

Mg	1	x	24	=	24	} 142 g/mol
C	4	x	12	=	48	
H	6	x	1	=	6	
O	4	x	16	=	64	

6. What is Avogadro's number?  $6.02 \times 10^{23}$

7. How many molecules are in 1 mole of water?

$$1 \text{ mol H}_2\text{O} \left| \frac{6.02 \times 10^{23} \text{ molecules H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = \frac{(1)(6.02 \times 10^{23})}{1} = 6.02 \times 10^{23} \text{ molecules H}_2\text{O} \right.$$

8. How many molecules are in  $5.34 \times 10^2$  moles of water?

$$5.34 \times 10^2 \text{ mol H}_2\text{O} \left| \frac{6.02 \times 10^{23} \text{ molecules H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 3.21 \times 10^{26} \text{ molecules H}_2\text{O} \right.$$

9. How many moles are in 12.4 g  $\text{Na}_2\text{O}$ ?

$$12.4 \text{ g Na}_2\text{O} \left| \frac{1 \text{ mol Na}_2\text{O}}{62 \text{ g Na}_2\text{O}} = \frac{(12.4)(1)}{62} = 0.200 \text{ mol Na}_2\text{O} \right.$$

Na	2	x	23	=	46
O	1	x	16	=	16
					62

10. How many moles are in 327.6 g  $\text{Ca}_3\text{P}_2$ ?

$$327.6 \text{ g Ca}_3\text{P}_2 \left| \frac{1 \text{ mol Ca}_3\text{P}_2}{182 \text{ g Ca}_3\text{P}_2} = 1.800 \text{ mol Ca}_3\text{P}_2 \right.$$

Ca	3	x	40	=	120
P	2	x	31	=	62
					182

11. How many grams are in 0.249 mol  $\text{Fe}_2\text{O}_3$ ?

$$0.249 \text{ mol Fe}_2\text{O}_3 \left| \frac{160 \text{ g Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} = 39.8 \text{ g Fe}_2\text{O}_3 \right.$$

<u>Fe<sub>2</sub>O<sub>3</sub></u>					
Fe	2	x	56	=	112
O	3	x	16	=	48
					160

12. How many grams are in 0.486 mol  $\text{NaCl}$ ?

$$0.486 \text{ mol NaCl} \left| \frac{58.5 \text{ g NaCl}}{1 \text{ mol NaCl}} = 28.4 \text{ g NaCl} \right.$$

<u>NaCl</u>					
Na	1	x	23	=	23
Cl	1	x	35.5	=	35.5
					58.5

13. If a drop of water weighs 1 g for every mL, how many  $\text{H}_2\text{O}$  molecules are in that drop?

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14. Calculate the percent composition of diphosphorus pentoxide?  $\text{P}_2\text{O}_5$

<u>P<sub>2</sub>O<sub>5</sub></u>	$\% \text{ P} = \frac{62}{142} \times 100\% = 43.7\%$	
P 2 x 31 = 62		
O 5 x 16 = 80		
} 142	$\% \text{ O} = \frac{80}{142} \times 100\% = 56.3\%$	

15. Calculate the percent composition of potassium in  $\text{KNO}_3$ ?

$$\begin{array}{l} \text{K } 1 \times 39 = 39 \\ \text{N } 1 \times 14 = 14 \\ \text{O } 3 \times 16 = 48 \end{array} \left. \vphantom{\begin{array}{l} \text{K } 1 \times 39 = 39 \\ \text{N } 1 \times 14 = 14 \\ \text{O } 3 \times 16 = 48 \end{array}} \right\} 101 \text{ g}$$

$$\% \text{ K} = \frac{39}{101} \times 100\% = 38.6\%$$

16. Determine the mass of nitrogen in 123g of  $(\text{NH}_4)_3\text{P}$ .

$$\textcircled{1} \begin{array}{l} \text{N } 3 \times 14 = 42 \\ \text{H } 12 \times 1 = 12 \\ \text{P } 1 \times 31 = 31 \end{array} \left. \vphantom{\begin{array}{l} \text{N } 3 \times 14 = 42 \\ \text{H } 12 \times 1 = 12 \\ \text{P } 1 \times 31 = 31 \end{array}} \right\} 85 \text{ g}$$

$$\% \text{ N} = \frac{42}{85} \times 100\% = 49.4\%$$

$$123 \text{ g} \times (\% \text{ N}) \times (0.494) = 60.8 \text{ g N}$$

17. Write the empirical formula for the following empirical formulas.



18. A compound consists of 12.5% H, 37.5% C, and 50.0% O. Find the empirical formula.

$$\begin{array}{l} 12.5 \text{ g H} / 1 \text{ g H} = 12.5 \text{ mol H} / 3.125 = 4 \\ 37.5 \text{ g C} / 12 \text{ g C} = 3.125 \text{ mol C} / 3.125 = 1 \\ 50.0 \text{ g O} / 16 \text{ g O} = 3.125 \text{ mol O} / 3.125 = 1 \end{array} \quad \text{H}_4\text{CO}$$

19. Ethylene, a gas used extensively in preparing plastics and other polymers, has a composition of 85.7% carbon and 14.3% hydrogen. Its molar mass is 28.0 g. Find the molecular formula for ethylene.

$$\begin{array}{l} \text{C } 85.7 \text{ g} / 12 \text{ g C} = 7.14 \text{ mol} / 7.14 = 1 \\ \text{H } 14.3 \text{ g} / 1 \text{ g H} = 14.3 \text{ mol} / 7.14 = 2 \end{array} \rightarrow \text{CH}_2$$

$$\textcircled{1} \begin{array}{l} \text{C } 1 \times 12 = 12 \\ \text{H } 2 \times 1 = 2 \\ \hline 14 \end{array} \quad \textcircled{3} (\text{CH}_2) \times 2 = \text{C}_2\text{H}_4$$

$$\textcircled{2} \frac{\text{molecular}}{\text{empirical}} = \frac{28}{14} = 2$$

20. A compound with an empirical formula of CH is found to have a molar mass of 26.0 g/mol. What is its molecular formula?

$$\textcircled{1} \begin{array}{l} \text{C } 1 \times 12 = 12 \\ \text{H } 1 \times 1 = 1 \\ \hline 13 \end{array} \quad \textcircled{2} \frac{\text{molecular}}{\text{empirical}} = \frac{26.0}{13} = 2 \quad \textcircled{3} (\text{CH}) \times 2 = \text{C}_2\text{H}_2$$

21. A white powder is analyzed and found to have an empirical formula of  $\text{P}_2\text{O}_5$ . The compound has a molar mass of 284 g/mol. What is the compound's molecular formula?

$$\textcircled{1} \begin{array}{l} \text{P}_2\text{O}_5 \\ \text{P } 2 \times 31 = 62 \\ \text{O } 5 \times 16 = 80 \\ \hline 142 \end{array} \quad \textcircled{2} \frac{\text{molecular}}{\text{empirical}} = \frac{284}{142} = 2 \quad \textcircled{3} (\text{P}_2\text{O}_5) \times 2 = \text{P}_4\text{O}_{10}$$