**Unit 3: Quantities in Chemical Reactions Review**

**Multiple Choice:** *Identify the letter of the choice that best completes the statement or answers the question.*

1. Chlorine has two naturally occurring isotopes, namely and . The composition of chlorine is 25.0% and 75.0% . The average atomic mass of chlorine is



|  |  |  |  |
| --- | --- | --- | --- |
| a. | 36.5 u | d. | 45.5 u |
| b. | 35.5 u | e. | 32.0 u |
| c. | 34.6 u |

2. A mass of 2.20 kg of sodium phosphate is converted into the following number of moles

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 7.45 mol | d. | 13.4 mol |
| b. | 74.5 mol | e. | 45.8 mol |
| c. | 1.34 x 10–2 mol |

3. The number of molecules found in 0.87 mol of carbon monoxide is

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 4.1 x 1023 molecules | d. | 9.3 x 1024 molecules |
| b. | 5.2 x 1023 molecules | e. | 1.5 x 1025 molecules |
| c. | 2.9 x 1024 molecules |

4. A 100.0-g sample of a compound is composed of 16.3 g of carbon, 32.1 g of chlorine, and

51.6 g of fluorine. The empirical formula of the compound is

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| --- | --- | --- | --- |
| a. | CClF | d. | C3Cl2F6 |
| b. | CClF3 | e. | C9Cl6F18 |
| c. | C2Cl2F6 |

5. When copper is combined with a solution of silver nitrate, the resulting products are copper(II) nitrate and silver. The balanced equation for this reaction is

|  |  |
| --- | --- |
| a. | Cu + 2AgNO3 Cu(NO3)2 + 2Ag |
| b. | 3Cu + 3AgNO3 3Cu(NO3)2 + 3Ag |
| c. | 2Cu + 2AgNO3 2CuNO3 + 2Ag |
| d. | Cu + 2AgNO3 CuNO3 + 2Ag |
| e. | 2Cu + 2AgNO3 2Cu(NO3)2 + 2Ag |

**Problem**

6. Magnesium hydroxide, Mg(OH)2, can be commonly found in antacids. Calculate the percentage composition, by mass, of each element in magnesium hydroxide.

7. A compound was found to contain 10.06% C, 89.10% Cl, and 0.84% H, by mass. If the molar mass of the compound is 119.6 g/mol, calculate its molecular formula.

8. Consider the following reaction: AlCl3(aq) + 4NaOH(aq) NaAlO2(aq) + 3NaCl(aq) + 2H2O(l)



How many grams of sodium chloride can be obtained from 4.46 g of AlCl3?

9. Sodium chloride is produced when sodium metal combines with chlorine gas as shown in the following balanced equation: 2 Na + Cl2 2 NaCl



In an experiment, 36.9 g of sodium chloride is produced when 15.9 g of Na and 27.4 g of chlorine are combined. Determine the percentage yield of the product.

**Unit #3: Quantities in Chemical Reactions Review Answer Section**

**MULTIPLE CHOICE**

1.B 2.D 3.B 4.D 5.A

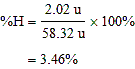
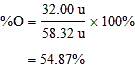
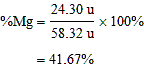
**PROBLEM**

6. *m*Mg = 24.30 u x 1 atoms = 24.30 u

*m*O = 16.00 u x 2 atoms = 32.00 u

*m*H = 1.01 u x 2 atoms = 2.02 u

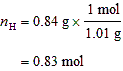
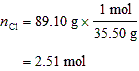
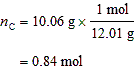
*m*total = 58.32 u



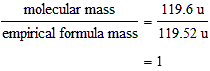
**The percentage composition, by mass, of Mg(OH)2 is 41.67% magnesium, 54.87% oxygen, and 3.46% hydrogen.**

7.

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| --- | --- | --- |
| *m*C = 10.06%  100.0 g C = 10.06 g |  | *M*C = 12.01 g/mol |
| *m*Cl = 89.10%  100.0 g Cl = 89.10 g |  | *M*Cl = 35.50 g/mol |
| *m*H = 0.84%  100.0 g H = 0.84 g |  | *M*H = 1.01 g/mol |



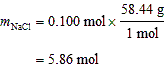
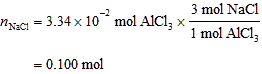
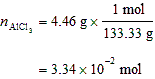
The molar ratio for C:Cl:H is 0.84:2.51:0.83. Dividing by 0.83 to obtain the lowest ratio, we obtain the molar ratio of 1:3:1. The empirical formula of the compound is CCl3H.



**The molecular formula of the compound is CCl3H.**

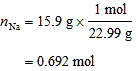
8.

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| mole ratio: | AlCl3:NaCl = 1:3 |

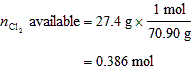
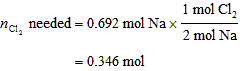


**The mass of sodium chloride that can be obtained is 5.86 g.**

9. We can determine the number of moles of chlorine needed to react completely with 15.9 g of Na.



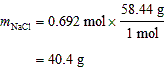
|  |  |
| --- | --- |
| mole ratio: | Na:Cl2 = 2:1 |



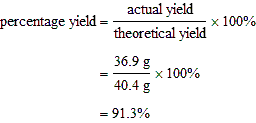
More chlorine is available than is required, therefore, chlorine is in excess. The sodium is the limiting reagent.



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| --- | --- |
| mole ratio: | Na:NaCl = 1:1 |



The theoretical yield of the NaCl is 40.4 g.



**The percentage yield is 91.3%.**