

## Unit 3 Quiz

You can use your periodic table and accompanying ion sheet. Please Show Your Work (PSYW) and Please Show Your Conversion Factors (PSYCF) where indicated. Box, circle, or underline answers.

1. Determine the mass of 2.45 moles of calcium hydroxide. PSYW/PSYCF

$$2.45 \overset{\text{mol}}{\text{Ca(OH)}_2} * \frac{74.09 \text{ g Ca(OH)}_2}{1 \text{ mol Ca(OH)}_2} = 181.520 \dots \text{ g} = \boxed{182 \text{ g Ca(OH)}_2}$$

2. Determine the number of atoms of  $^{13}\text{Al}$  in a 3.92-gram sample of aluminum foil. PSYW/PSYCF

$$3.92 \text{ g Al} * \frac{1 \text{ mol Al}}{26.98 \text{ g Al}} * \frac{6.022 \times 10^{22} \text{ atoms}}{1 \text{ mol}} = \boxed{8.75 \times 10^{22} \text{ atoms}}$$

3. Determine the molar mass of magnesium phosphate. PSYW

$$\text{Mg}_3(\text{PO}_4)_2 : 3 \times (24.3050) + 2 \times (30.97376) + 8 \times (15.9994) \\ = \boxed{262.86 \text{ g/mol}}$$

4. Write the molecular formula of iron(III) carbonate and determine the percent composition of the three elements in the compound. PSYW

$$\text{Fe}_2(\text{CO}_3)_3 : 2(55.845) + 3(12.0107) + 9(15.9994) = 291.7167 \frac{\text{g}}{\text{mol}}$$

$$\% \text{ Fe} = \frac{2(55.845)}{291.7167} * 100 = \underline{\underline{38.29\%}}$$

$$\% \text{ C} = \frac{3(12.0107)}{291.7167} * 100 = \underline{\underline{12.35\%}}$$

$$\% \text{ O} = \frac{9(15.9994)}{291.7167} * 100 = \underline{\underline{49.36\%}}$$

5. A compound has an empirical formula of  $\text{CH}_2$  and a molar mass of 84 g/mol. What is the molecular formula of the compound? Explain your answer.

Molecular Formula:  $\text{C}_6\text{H}_{12}$

$$\text{CH}_2 \Rightarrow 14 \text{ g/mol}$$

Explanation:

$$\frac{84}{14} = 6$$

The empirical mass of  $\text{CH}_2$  is 14 g/mol. This divides into the molar mass six times. Thus the subscripts of the molecular formula are six times that of the empirical formula.

6. A forensic analysis is conducted of the shirt sleeve of a crime scene victim and a chemical compound is found that is 63.56% C, 6.00% H, 9.27% N, and 21.17% O. Determine the empirical formula of the compound. PSYW

Assume a 100-gram sample

$$63.56 \text{ g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} = 5.29 \text{ mol C}$$

$$6.00 \text{ g H} \times \frac{1 \text{ mol H}}{1 \text{ g H}} = 6.00 \text{ mol H}$$

$$9.27 \text{ g N} \times \frac{1 \text{ mol N}}{14.01 \text{ g N}} = 0.662 \text{ mol N}$$

$$21.17 \text{ g O} \times \frac{1 \text{ mol O}}{15.999 \text{ g O}} = 1.323 \text{ mol O}$$

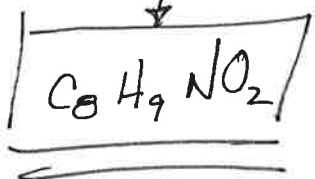
$$\div 0.662 =$$

$$7.99 \text{ mol C}$$

$$9.06 \text{ mol H}$$

$$1.00 \text{ mol N}$$

$$1.998 \text{ mol O}$$



## Unit 3 Quiz

You can use your periodic table and accompanying ion sheet. Please Show Your Work (PSYW) and Please Show Your Conversion Factors (PSYCF) where indicated. Box, circle, or underline answers.

1. Determine the mass of 5.21 moles of calcium hydroxide. PSYW/PSYCF

$$5.21 \text{ mol Ca(OH)}_2 * \frac{74.09 \text{ g Ca(OH)}_2}{1 \text{ mol Ca(OH)}_2} = \boxed{386 \text{ g Ca(OH)}_2} \quad (386.0089 \text{ g})$$

2. Determine the number of atoms of  $^{13}\text{Al}$  in a 4.78-gram sample of aluminum foil. PSYW/PSYCF

$$4.78 \text{ g Al} * \frac{1 \text{ mol Al}}{26.98 \text{ g Al}} * \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mol Al}} = \boxed{1.07 \times 10^{23} \text{ atoms}}$$

$(1.066907 \times 10^{23} \text{ atoms})$

3. Determine the molar mass of aluminum carbonate. PSYW

$$\text{Al}_2(\text{CO}_3)_3 : 2 * (26.981538) + 3(12.0107) + 9(15.9994)$$

$$= \boxed{233.99 \text{ g/mol}}$$

4. Write the molecular formula of copper(II) phosphate and determine the percent composition of the three elements in the compound. PSYW

$$\text{Cu}_3(\text{PO}_4)_2 : 3 * (63.546) + 2(30.97366) + 8(15.9994) = 380.58 \frac{\text{g}}{\text{mol}}$$

$$\% \text{ Cu} = \frac{3 * (63.546)}{380.58} * 100 = \underline{\underline{50.09\%}}$$

$$\% \text{ P} = \frac{2 * (30.97366)}{380.58} * 100 = \underline{\underline{16.28\%}}$$

$$\% \text{ O} = \frac{8 * (15.9994)}{380.58} * 100 = \underline{\underline{33.63\%}}$$

5. A compound has an empirical formula of  $\text{CH}_2$  and a molar mass of 70.0 g/mol. What is the molecular formula of the compound? Explain your answer.

Molecular Formula:  $\text{C}_5\text{H}_{10}$        $\text{CH}_2 \rightarrow 14\text{g/mol}$

Explanation:

The empirical formula has a "molar mass" of 14g/mol. This divides into the actual molar mass 5 times. Thus the subscripts of the molecular ~~mass~~ formula are 5 times that of the empirical formula.

$\frac{70}{14} = 5$

6. A forensic analysis is conducted of the shirt sleeve of a crime scene victim and a chemical compound is found that is 75.42% C, 6.63% H, 8.38% N, and 9.57% O. Determine the empirical formula of the compound. PSYW

Assume a 100.0-gram sample

$$75.42\text{g C} \times \frac{1\text{ mol C}}{12.011\text{g C}} = 6.279\text{ mol C}$$

$$6.63\text{g H} \times \frac{1\text{ mol H}}{1.0079\text{g H}} = 6.578\text{ mol H}$$

$$8.38\text{g N} \times \frac{1\text{ mol N}}{14.0067\text{g N}} = 0.5982\text{ mol N}$$

$$9.57\text{g O} \times \frac{1\text{ mol O}}{15.9994\text{g O}} = 0.598\text{ mol O}$$

$\div 0.598 \Rightarrow$

10.5 mol C

11 mol H

1 mol N

1 mol O

