**Quiz 7A**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. Adipic acid is used in the manufacture of nylon. Answer the following questions about it.

* 1. Using the Lewis structure above, what is the chemical formula? \_\_\_\_\_C6H10O4
	2. Classify it as a hydrocarbon, alcohol, ether, or carboxylic acid. \_\_\_\_\_carboxylic acid
	3. What is the molar mass? \_\_\_\_\_146.142 g/mol
	4. Write the balanced combustion reaction for liquid adipic acid.

2 C6H10O2 (l) + 13 O2 (g) → 12 CO2 (g) + 10 H2O (g)

* 1. A 2.018 g sample that contains carbon, hydrogen, and oxygen was combusted with excess oxygen gas and 3.646 g of carbon dioxide and 1.244 g of water vapor were produced. The approximate molar mass of the compound is 146 g/mol. Determine the empirical and molecular formula of the sample. Does it have the same chemical formula as adipic acid?

$3.646 g CO\_{2}×\frac{1 mol CO\_{2}}{44.009 g CO\_{2}}×\frac{1 mol C}{1 mol CO\_{2}}=0.08284669 mol C×\frac{12.011 g C}{1 mol C}=0.995071599 g C $

$1.244 g H\_{2}O×\frac{1 mol H\_{2}O}{18.015 g H\_{2}O}×\frac{2 mol H}{1 mol H\_{2}O}=0.138107133 mol H×\frac{1.008 g H}{1 mol H}=0.13921199 g H$

$m\_{O}=2.018 g-0.995071599 g- 0.13921199 g=0.883716411 g O $

$0.883716411 g O×\frac{1 mol O}{15.999 g O}=0.055235728 mol O $

 $C\_{\frac{0.08284669}{0.055235728}}H\_{\frac{0.138107133}{0.055235728}}O\_{\frac{0.055235728}{0.055235728}}=\left(C\_{1.499875047}H\_{2.500322491}O\_{1}\right)×2=$

$$C\_{2.999750094}H\_{5.000644982}O\_{2}≈C\_{3}H\_{5}O\_{2} is the empirical formula$$

$$The calculated empirical mass=73.071\frac{g}{mol}$$

$$ratio=\frac{molecular mass}{empirical mass}=\frac{146\frac{g}{mol}}{73.071\frac{g}{mol}}=1.998056685≈2$$

$$The molecular formula is \left(C\_{3}H\_{5}O\_{2}\right)\_{2}=C\_{6}H\_{10}O\_{4} $$

Therefore, the sample has the same chemical formula as adipic acid.