**Quiz 4**

# 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. Sodium sulfate occurs naturally as the mineral thenardite. To analyze an impure mineral sample for the quantity of sodium sulfate, the sample is crushed, and then dissolved in water to form a solution of sodium sulfate. Next, the aqueous solution is treated with aqueous barium chloride to give barium sulfate (12 points).

Na2SO4 (aq) + BaCl2 (aq) → 2 NaCl (aq) + BaSO4 (s)

* 1. Write the total ionic and net ionic equations.

2 Na+ (aq) + SO42- (aq) + Ba2+ (aq) + 2 Cl- (aq) → 2 Na+ (aq) + 2 Cl- (aq) + BaSO4 (s)

SO42- (aq) + Ba2+ (aq) → BaSO4 (s)

* 1. Suppose that a 0.4980 g sample containing thenardite produces 0.541 g of solid barium sulfate. What is the mass percent of sodium sulfate in the sample?

$$0.541 g BaSO\_{4}×\frac{1 mol BaSO\_{4}}{233.384 g BaSO\_{4}}×\frac{1 mol Na\_{2}SO\_{4}}{1 mol BaSO\_{4}}×\frac{142.037 g Na\_{2}SO\_{4}}{1 mol Na\_{2}SO\_{4}}=0.32951435 g Na\_{2}SO\_{4}≈0.330g Na\_{2}SO\_{4}$$

$$mass\%= \frac{0.32951435 g Na\_{2}SO\_{4}}{0.4980 g thenardite}×100=66.11474606\%≈66.1\% Na\_{2}SO\_{4} $$

1. When a 1.125 g of a liquid hydrocarbon, CxHy, underwent combust 3.447 g of carbon dioxide and 1.647 g of water vapor were produced (8 points).
	1. What is the empirical formula of the hydrocarbon?

$$3.447 g CO\_{2}×\frac{1 mol CO\_{2}}{44.009 g CO\_{2}}×\frac{1 mol C}{1 mol CO\_{2}}=0.078324888 mol C$$

$$1.647 g H\_{2}O×\frac{1 mol H\_{2}O}{18.015 g H\_{2}O}×\frac{2 mol H}{1 mol H\_{2}O}=0.182847627 mol H$$

$$C\_{\frac{0.078324888}{0.078324888}}H\_{\frac{0.182847627}{0.078324888}}=\left(C\_{1}H\_{2.334476709}\right)\_{3}=C\_{3}H\_{7.003430128}=C\_{3}H\_{7}$$

* 1. In a separate experiment the molar mass of the compound was found to be 86.2 g/mol. What is the molecular formula of the hydrocarbon?

$$ratio=\frac{molar mass}{empirical mass}=\frac{86.2\frac{g}{mol}}{43.089\frac{g}{mol}}=2.000510571≈2$$

$$Therefore the molecular formula is \left(C\_{3}H\_{7}\right)\_{2}=C\_{6}H\_{14}$$