

**AP Exam Review-Stoichiometry/Solution Stoichiometry** Name: \_\_\_\_\_ Period: \_\_\_\_\_

1) An unknown compound contains only the three elements C,H, and O. A pure sample of the compound is analyzed and found to be 65.60 percent C and 9.44 percent H by mass.

(a) Determine the empirical formula of the compound.

(b) A solution of 1.570 grams of the compound in 16.08 grams of camphor is observed to freeze at a temperature 15.2 Celsius degrees below the normal freezing point of pure camphor. Determine the molar mass and apparent molecular formula of the compound. (The molal freezing-point depression constant,  $K_f$ , for camphor is  $40.0 \text{ kg}\cdot\text{K}\cdot\text{mol}^{-1}$ .)

(c) When 1.570 grams of the compound is vaporized at  $300^\circ\text{C}$  and 1.00 atmosphere, the gas occupies a volume of 577 milliliters. What is the molar mass of the compound based on this result?

(d) Briefly describe what occurs in solution that accounts for the difference between the results obtained in parts (b) and (c).

2) Concentrated sulfuric acid (18.4-molar  $\text{H}_2\text{SO}_4$ ) has a density of 1.84 grams per milliliter. After dilution with water to 5.20-molar, the solution has a density of 1.38 grams per milliliter and can be used as an electrolyte in lead storage batteries for automobiles.

(a) Calculate the volume of concentrated acid required to prepare 1.00 liter of 5.20-molar  $\text{H}_2\text{SO}_4$ .

(b) Determine the mass percent of  $\text{H}_2\text{SO}_4$  in the original concentrated solution.

(c) Calculate the volume of 5.20-molar  $\text{H}_2\text{SO}_4$  that can be completely neutralized with 10.5 grams of sodium bicarbonate  $\text{NaHCO}_3$ .

(d) What is the molality of the 5.20-molar  $\text{H}_2\text{SO}_4$  ?