Name _____

Period ____   Date ____/____/____

14 • Solutions and Their Properties

1996 B

Concentrated sulfuric acid (18.4-molar H_2SO_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.
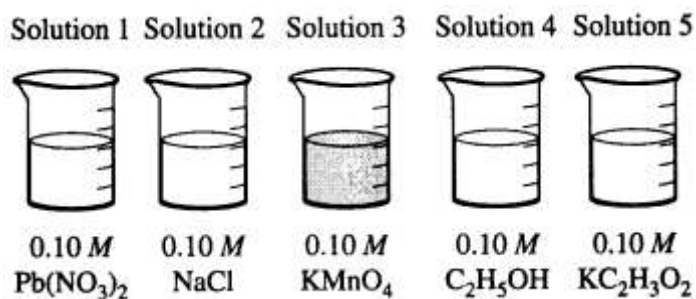
(a) Calculate the volume of concentrated acid required to prepare 1.00 liter of 5.20-molar H_2SO_4.

(b) Determine the mass percent of H_2SO_4 in the original concentrated solution.

(c) Calculate the volume of 5.20-molar H_2SO_4 that can be completely neutralized with 10.5 grams of sodium bicarbonate, $NaHCO_3$.

(d) What is the <u>molality</u> of the 5.20-molar H_2SO_4?

1998 B

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 kg·K·mol^{-1}.)

(c) When 1.570 grams of the compound is vaporized at 300°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).

Solution 1 Solution 2 Solution 3   Solution 4 Solution 5

| 0.10 M | 0.10 M | 0.10 M | 0.10 M | 0.10 M |
| $Pb(NO_3)_2$ | $NaCl$ | $KMnO_4$ | C_2H_5OH | $KC_2H_3O_2$ |

Answer the questions below that relate to the five aqueous solutions at 25°C shown above.

(a) Which solution has the highest boiling point? Explain.

(b) Which solution has the highest pH? Explain.

(c) Identify a pair of the solutions that would produce a precipitate when mixed together. Write the formula of the precipitate.

(d) Which solution could be used to oxidize the $Cl^-_{(aq)}$ ion? Identify the product of the oxidation.

(e) Which solution would be the least effective conductor of electricity? Explain.