

Time: 1 hour

Chemistry 210

June 10, 1998

Final Examination

H. Sleiman

Name:

Student Number:

Major:

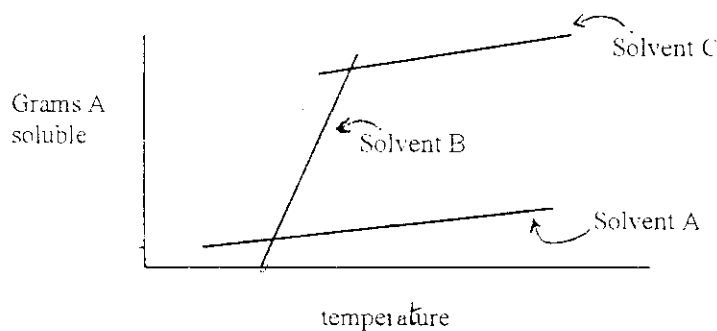
Instructor:

I. Show how to prepare p-nitroaniline from aniline, using chemical equations.

↳ (10%)

II.

1. Given the following solubility vs. temperature diagram for solute x in solvents A, B, and C, which solvent would be your choice for a recrystallization solvent of x? Explain. (15%)



2. The solid substance x is soluble in water to the extent of 2g/100mL at 25°C and 10g/100mL at 100°C. What procedure would you use to purify x from a mixture containing 10g x and 3g of an impurity y if:
- y is completely soluble in water (hot or cold)

- b. y is completely insoluble in water

- c. y has the same solubility of x in water

III. (24) Circle the correct choice. Only one answer is possible.

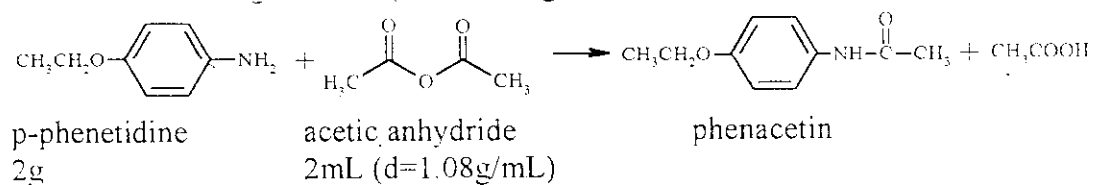
1. Circle the correct statement:
 - a. Added methanol increases the boiling point of ethanol
 - b. Added benzoic acid lowers the melting point of solid benzene
 - c. Added sand raises the boiling point of water
 - d. Added salt increases the melting point of water

2. During a recrystallization, a minimum amount of boiling solvent is used in order to:
 - a. prevent a reaction of the solvent with the material to be recrystallized
 - b. maximize the purity of the recrystallized material
 - c. maximize the yield of recrystallized material
 - d. minimize the melting point of recrystallized material

3. Sodium bicarbonate was used in the purification of isopentyl acetate to:
 - a. separate isopentyl acetate from acetic acid
 - b. separate isopentyl acetate from isopentyl alcohol
 - c. drive the equilibrium of the esterification to the products
 - d. none of the above

4. The R_f values of p-nitroaniline, o-nitroaniline and o-nitroacetanilide are in the following order:
 - a. $R_f(\text{o-nitroacetanilide}) > R_f(\text{p-nitroaniline}) > R_f(\text{o-nitroaniline})$
 - b. $R_f(\text{o-nitroaniline}) > R_f(\text{o-nitroacetanilide}) > R_f(\text{p-nitroaniline})$
 - c. $R_f(\text{o-nitroacetanilide}) > R_f(\text{o-nitroaniline}) > R_f(\text{p-nitroaniline})$
 - d. $R_f(\text{p-nitroaniline}) > R_f(\text{o-nitroacetanilide}) > R_f(\text{o-nitroaniline})$

5. In the following reaction (atomic weights C=12; H=1; O=16; N=14)



The limiting reagent is ----- and the theoretical yield of phenacetin is---- (answer below)

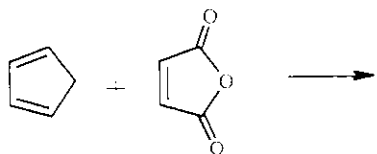
- acetic anhydride, 3.8g
 - p-phenetidine, 3.8g
 - p-phenetidine, 2.6g
 - acetic anhydride, 2.6g
6. During a fractional distillation, how does the temperature of the vapor just above the liquid compare with the temperature recorded by the thermometer above the fractionation column?
- Higher
 - Lower
 - Same
 - Depends on particular liquid mixture

IV. In 1951, an obscure group of chemists (lead by G. Rosenkranz and C. Djerassi) first synthesized what they thought was cortisone. They sent a sample of this compound to T. Reichstein, who had received the Nobel Prize for isolating cortisone from natural sources, and who had samples of authentic cortisone. The chemists were very happy when a telegram from Reichstein arrived: "No depression in the mixed melting point". Explain.

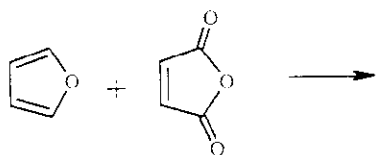
(7%)

(12%) V. Complete the following equations and circle the more reactive pair in each of these. Explain briefly.

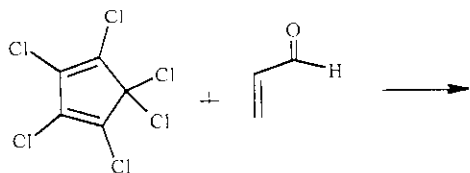
1.



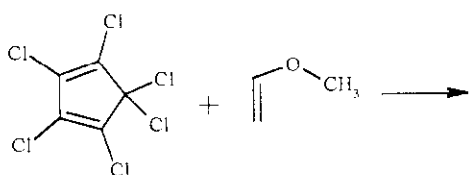
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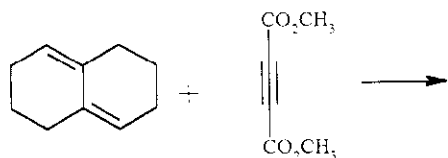
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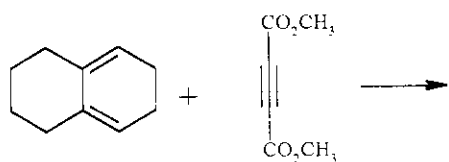
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3.



and



- VI. To what external pressure should the system be reduced, so that a mixture of 50g n-pentane and 50g n-heptane begins to boil at 40°C? What is the weight composition of the first drops of distillate?
(10%)
(at 40°C, $P^{\circ}_{(n\text{-pentane})}=873$ mm Hg and $P^{\circ}_{(n\text{-heptane})}=92$ mm Hg)

- VII. Draw a column chromatography set-up, labeling all parts.
(10%)

- VIII. Show a step-by-step experimental procedure to prepare and purify cyclohexanone from cyclohexanol. (use back of this page)
(12%)