Ch 339 - Final Exam **Name**_____
Spring, 2000 **Lab days (circle)** **MW** **TTh**
100 pts

1. (6) What conclusions can be drawn from ignition tests that yield the following results?

a) yellow, sooty flame

b) clear, bluish flame

c) residue which doesn't go away with more heat

2. (6) a) The separation of a racemic mixture into pure enantiomers is called _____.
b) What property of diastereomeric salts made it possible to separate the racemic α-phenylethylamine?

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3. (7) If a pure dextrorotatory enantiomer has $[\alpha]_D^{20} = +120^o$, what will be the rotation of a mixture containing 80% of the (+)-enantiomer and 20% of the (–)-enantiomer? Show your work.

4. (15) An unknown compound, **A**, having the molecular formula $C_5H_{12}O$, burned with a clear, blue flame, was soluble in ether and slightly soluble in water. It gave a positive test with Jones reagent (CrO_3/H_2SO_4), producing a new compound, **B**, having the formula $C_5H_{10}O$. Compound **B** gave a positive iodoform test, and formed a semicarbazone. Compound **A** on treatment with sulfuric acid produced a hydrocarbon, **C**, with the formula C_5H_{10}. Hydrocarbon **C** readily decolorized Br_2/CH_2Cl_2, and on ozonolysis produced acetone as one of the products. Give the structures of **A**, **B**, and **C**. Explain your answer, including the significance of the classification tests.

5. In the organic labs, you encountered three experimental methods that were classified as chromatography.

a) (6) List the three methods.

b) (3) Describe the features that are common to all forms of chromatography.

c) (4) Indicate why a separation takes place.

6. You are planning to oxidize benzyl alcohol to benzoic acid with chromic anhydride, according to the following balanced equation. (Molecular weights are given in parentheses.)

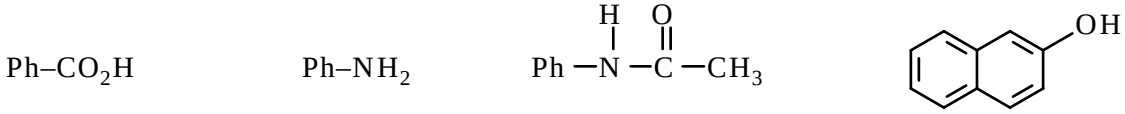
$$\underset{(108)}{3\text{Ph-CH}_2\text{OH}} + \underset{(100)}{4\text{CrO}_3} + \underset{(98)}{6\text{H}_2\text{SO}_4} \longrightarrow \underset{(122)}{3\text{Ph-COOH}} + \underset{(392)}{2\text{Cr}_2(\text{SO}_4)_3} + \underset{(18)}{9\text{H}_2\text{O}}$$

a) (6) Calculate the oxidation number of the alcohol carbon in benzyl alcohol as well as the carbonyl carbon in benzoic acid, and indicate why the alcohol is said to be oxidized.

b) (5) How many grams of benzyl alcohol should you start with if you want to prepare 50 g of benzoic acid and you expect a yield of 70%? Show your work.

c) (4) What is the minimum weight of CrO_3 you would need to oxidize all of the benzyl alcohol you start with? Show your work.

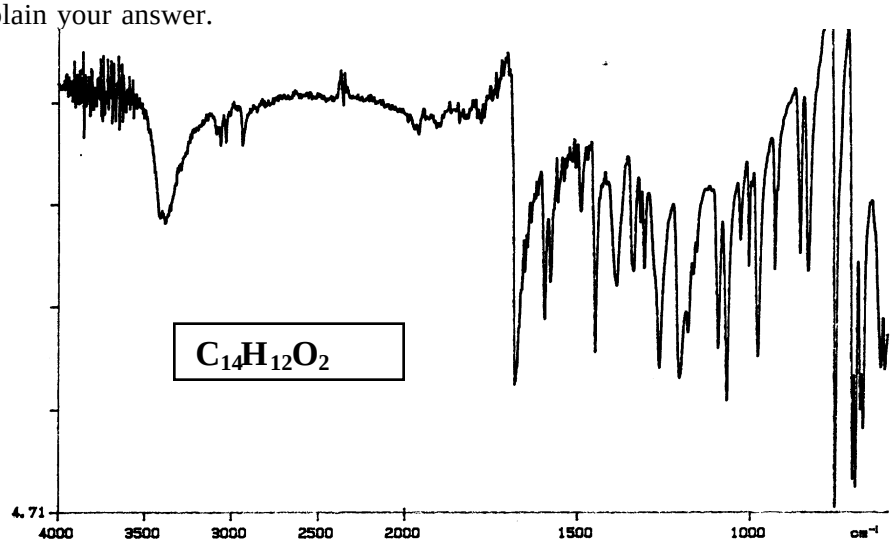
7. (20) Sitting in front of you on the lab bench is an unattractive, gloppy mixture containing the four compounds shown below: an acid, a phenol, an amine, and an amide. All are relatively insoluble in water, and all are solids at room temperature except the amine (aniline). Show how this mixture can be separated into its components using chemically active extraction techniques. Prepare a numbered list of the steps involved, starting with the operation shown. Write balanced equations for all reactions taking place.



1. Dissolve the mess in ether.

2.

8. (8) The compound whose infrared spectrum and molecular formula are given below was encountered in the lab this term. Assign obvious IR peaks to the appropriate functional groups. Give the structure of this compound, and explain your answer.



9. (6) Circle the compound below that would have the strongest C=C stretching absorption in the infrared spectrum (assuming equal molar concentrations). Underline the compound that would have the weakest C=C stretching absorption. Explain your answer.

a) CH_3-CH=CH-CH_2-CH_3 b) CH_2=CH-CH_2-CH_3 c) CH_2=CCl_2

10. (8) Suggest a method for preparing the benzyltriphenylphosphonium bromide used in the Wittig reaction. Also give the mechanism for its formation.

11. a) (6) Give the chemical formulas of two of the solid drying agents that you used in the lab, and indicate briefly how they work. (Include any reactions.)

b) (2) What liquid 'drying agent' did you encounter in the lab?

12. (10) The following five substances have approximately the same boiling point and all are colorless liquids. Suppose that you were given five unlabeled bottles, each of which contains one of these compounds. Explain how you would use simple chemical tests to identify the contents of each bottle.

propanoic acid _____

_____

propyl butanoate _____

_____

1-pentanol _____

_____

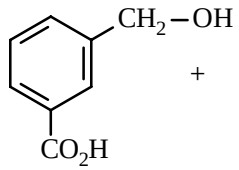
ethylbenzene _____

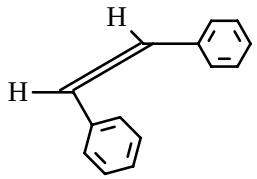
_____

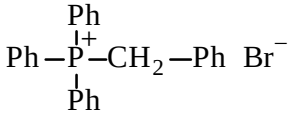
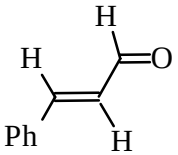
diisobutylamine _____

_____

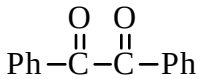
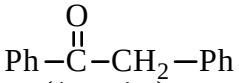
13. (25) Complete the following, showing stereochemistry clearly for those marked with a star (★).

a)  + $KHCO_3$ (excess) ⟶

★ b)  Br_2 ⟶ _____ KOH (1 equiv.) ⟶ _____

★ c)  $NaNH_2$ ⟶ _____  ⟶ _____

★ d)  ⟶ $\triangle$

e)  +  (1 equiv.) ⟶ OH^-, $\triangle$