### **CHEM 3590 Instrumental Analysis**

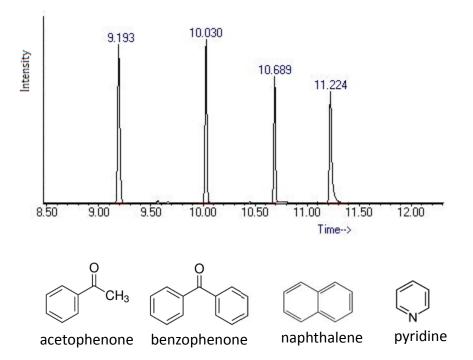
**Test 2**, November 13, 2015

Parker 539 Time: 10:30-11:30 am VERSION A

Please answer 8 questions out of 10. Only 8 questions will be marked. All questions are weighed equally.

## **Question 1:**

A mixture of the four compounds analyzed by gas chromatography (GC) produced the following result:



- a) Assign each compound to its appropriate peak. Justify.
- b) Give three parameters that could be changed to make all compounds elute faster.

## **Question 2:**

Suggest, if needed, a derivatization reaction that could be used for the analysis of benzoic acid by gas chromatography with an electron capture detector. benzoic acid

### **Question 3:**

- a) Explain, in a reaction, how ions are formed by electron impact ionization.
- b) What types of molecules is this technique used for?

## Question 4:

Given the three compounds shown here to be separated by reversed phase HPLC:

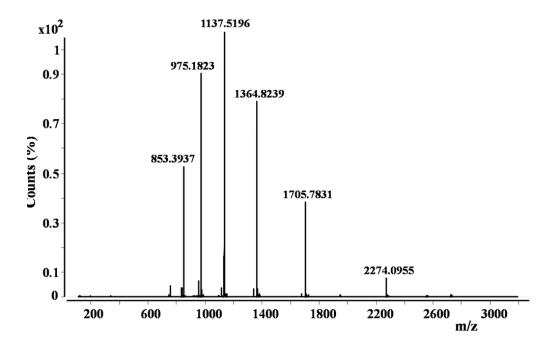
- a) What would be their elution order? Justify.
- b) What would be the effect of ion pairing with the reagent shown below?

### **Question 5:**

What are the excitation and fluorescence spectra of organic molecules and how are they obtained using a spectrofluorimeter?

# **Question 6:**

Calculate the molecular mass of the compound that produced this electrospray spectrum:



## **Question 7:**

In the equation  $K_{av} = \frac{V_r - V_0}{V_m - V_0}$  which is relevant to size exclusion chromatography, define each  $V_m - V_0$ 

term  $(V_r, V_m, V_0)$  and explain how it is measured.

## **Question 8:**

Two amino acids, tyrosine and phenylalanine, are to be separated by anion exchange chromatography on trimethylbenzylammonium beads (pKa = 9.8).

$$H_2N$$
— $CH$ — $C$ — $OH$ 
 $H_2N$ — $CH$ — $C$ — $OH$ 
 $CH_2$ 
 $CH_2$ 

Tyrosine, pI = 5.66

If the mobile phase is at pH 7, which amino acid forms the stronger interaction with the beads (and will elute second)? Justify.

## **Question 9:**

How does an electron capture detector create a signal when analyzing halogenated compounds by GC?

## **Question 10:**

The chromatogram below was obtained at a single absorbance wavelength (254 nm) for a mixture of polycyclic aromatic compounds. Is it possible to relate relative peak heights directly to concentrations in the sample? Justify.

