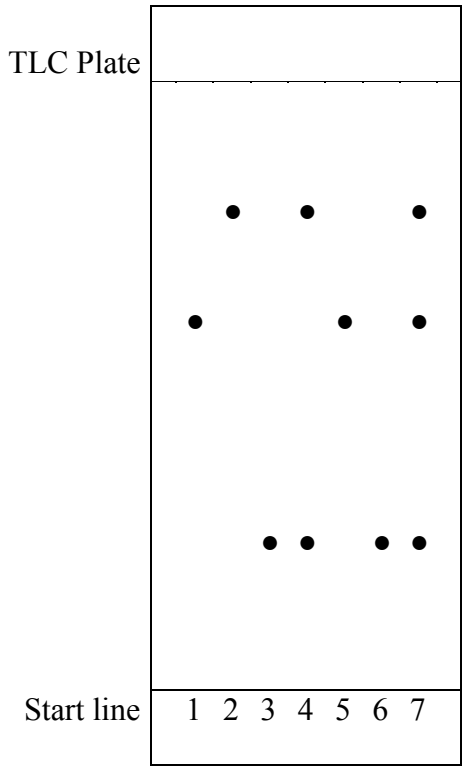
A student extracted the active ingredient from several analgesic over-the-counter drugs to determine the composition of each one. Based on the label he tested all the drugs to see if they contain acetaminophen (ACE), aspirin (ASP) and caffeine (CAF). However, he forgot to label which spot corresponds to which drug. Shown below is the TLC plate the student obtained from his experiment after extraction from Anacin®, Tylenol®, Vivarin® and Excedrin® and using 2% acetic acid and 98% ethyl acetate as the mobile phase.



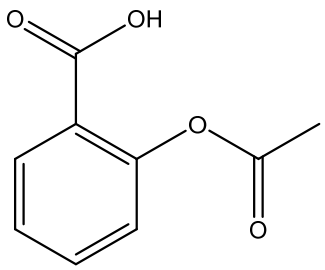
Sample Spots:

1. ACE
2. ASP
3. CAF
4. Unknown A
5. Unknown B
6. Unknown C
7. Unknown D

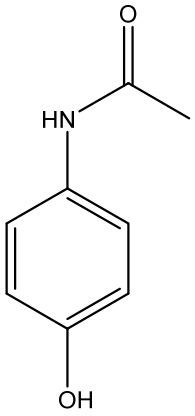
Consider the TLC plate shown above and answer the following questions.

1. Calculate the R_f value for each of the analgesic components, ACE, ASP and CAF. You must show your work for full credit. (1.5 pts)

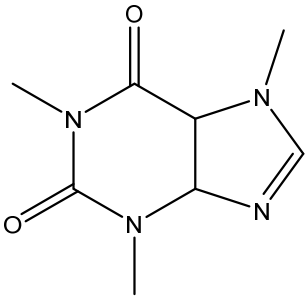
2. Match the identity of the unknowns to the 4 listed OTC drugs (Anacin®, Tylenol®, Vivarin® and Excedrin®). (4 pts)



ASP
Aspirin



ACE
Acetaminophen



CAF
Caffeine

3. Based on your R_f calculations rank ACE, ASP or CAF in order of increasing polarity. Consider the structure of the three compounds (shown below) would you have predicted the order of polarity to be the same? Explain. (2.5 pts)
4. When ACE, ASP and CAF were analyzed by TLC using 2:9:9 mixture of t-butyl alcohol, 4-methyl-2-pentanone and ethyl acetate respectively the following R_f values were obtained: ACE (0.51), ASP (0.15) and CAF (0.35). These results are not the same ones obtained when using 2% acetic acid and 98% ethyl acetate as the mobile phase? Explain why were the results different for our case (TLC shown) particularly for caffeine. (4 pts)
5. Give the R_f values you obtained in lab for the compounds extracted in last week's lab (benzoic acid, 2-naphthol and naphthalene). Were all the compounds pure? Were there any impurities in any of the solids obtain. Which of the solids was the purest and which was the least pure based on the TLC? (4 pts)