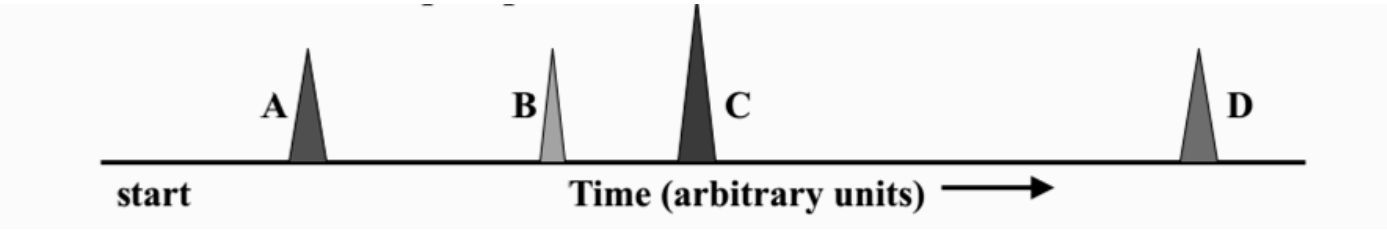
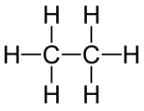
Gas Chromatography

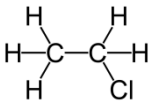
Gas--liquid chromatography, or GC for short, physically separates liquids in a mixture according to a number of factors, the most significant one of which is intermolecular forces of attraction. Mixtures of liquids are injected into a heater section (referred to as an oven) kept at constant temperature. As the liquids evaporate, the vapors are carried along through the apparatus with a stream of nonreactive gas, such as neon or nitrogen (N_2), very similarly to the solvent in the chromatography we performed in the lab. Because the liquids exhibit different magnitudes of intermolecular attractions they will exhibit different vapor pressures at the ambient oven temperature, so they will evaporate at different times. Retention time (Rt) is the difference in time between when a substance was injected and when it exits the GC.

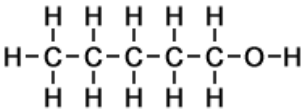
A mixture of four hydrocarbons was injected into a GC at T_{oven}= 85^{o}C, giving the chromatogram below. Which compound spends the most time in the liquid phase?

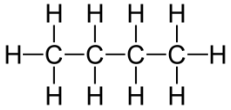


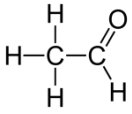
Of the choices below, which is predicted to have the longest Rt?

a. 

b. 

c. 

d. 

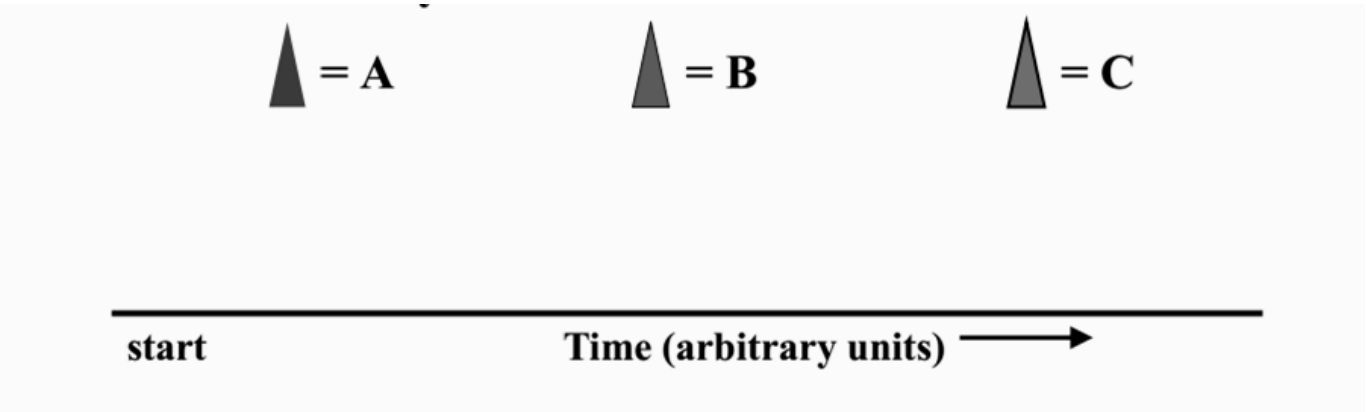
e. 

Suppose a mixture of three liquid hydrocarbons-- A, B, and C-- was injected into a GC with constant oven temperature, T_{oven}

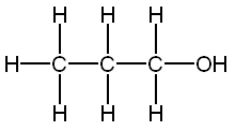
What types of intermolecular forces of attraction should hydrocarbons exhibit?

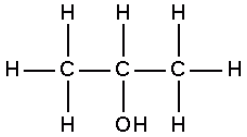
What effect would molecular weight have on this?

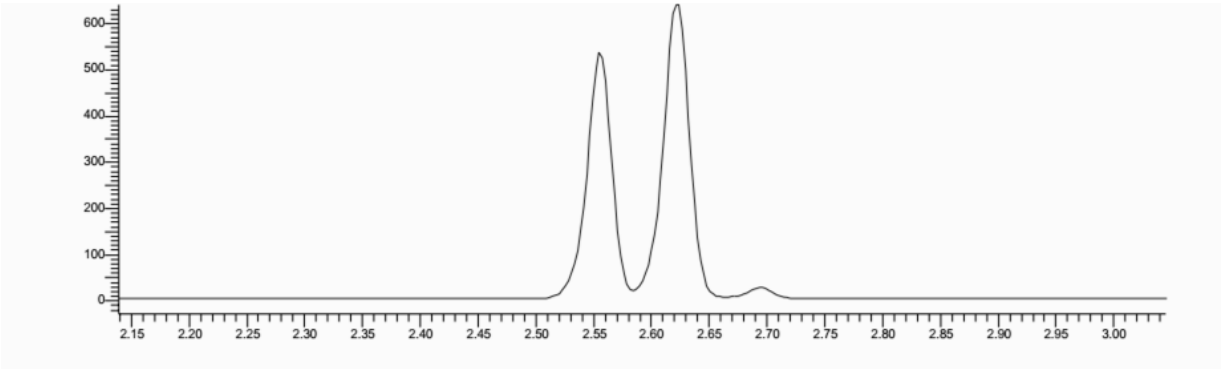
The relative MWs of the three hydrocarbons are B> A > C. Based on this information arrange the three compounds in the order that they elute or exit from the column by arranging/drawing their “peaks” on the time axis in the appropriate order.



The chromatogram below is for a two component liquid mixture, containing the alcohols 1--propanol and 2--propanol. Both alcohols have the molecular formula C_3H_8O, and hence the same molecular weight (MW). Yet, as shown the two alcohols have different retention times (Rt) under identical GC conditions. Since their MWs are the same, their differences in Rt cannot be explained on account of a difference in MW. So what then is a plausible explanation for why they have different retention times? Which peak is which alcohol?

1-propanol: 

2-propanol: 



Portions adapted from:
http://www.azwestern.edu/downloads/NSF%20Grants/GC-CHN/05%20GC%20in%20Gen%20Chem-Why%20wait.pdf