1. a) at room temperature:  Acetone: liquid ③
                            ethane : gas ①
                            acetaldehyde : gas or liquid ②
                            ethanol : liquid ④

   b) FID would be good as all compounds have carbon atoms.
      HS would also work
      Also FTIR is possible as GC detector.

2. a) Dansyl chloride is a reagent to label amino acids
      at their N-terminus. Also works for other primary
      or secondary amines. This reagent allow amino
      acids to fluoresce.

   b) Because there is typically one label per amino
      acid, the intensity of fluorescence and be directly
      related to the concentration, for one species or for
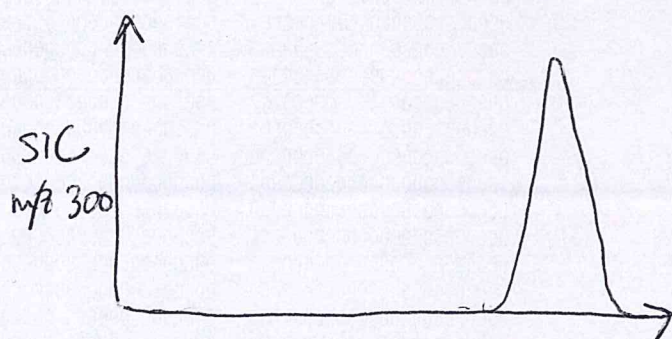      a mixture of amino acids.

3.

a) TIC: for each full scan in MS, the sum of all ion intensities is added up and this sum gives a dot on the chromatogram. (e.g. ●)



$M^{+\cdot} = 250$

$M^{+\cdot} = 300$

TIC

m/z

r. time
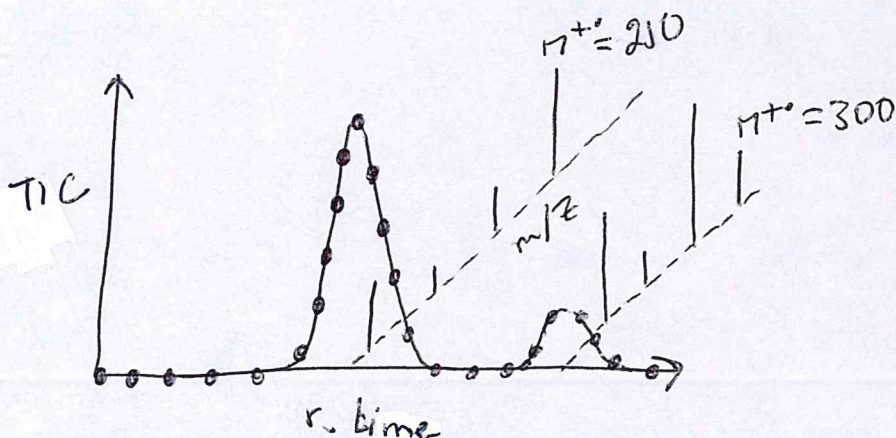
SIC: once GC/MS data are collected, one can go back to the data and extract the chromatogram for a single m/z value



SIC m/z 300

(m/z 250 not observed on this trace).

b) TIC: is universal as much as a FID trace. Shows all compounds eluting from the column.

SIC: selective. Shows exactly where a compound of interest elutes.

4. This could be done using reversed phase.

    The least polar compound is ③ and will come last.

    The most polar is ② and would come first

    ④ would elute after ②, followed by ①

        the order would be 2, 4, 1, 3.

    Stationary phase: $C_{18}$; mobile phase water - acetonitrile

                         or water - methanol.

5. UV absorption spectrum: Absorbance vs. $\lambda$. Transmittance measured at 180°

    Excitation spectrum: Intensity of fluorescence vs. $\lambda$ exc while keeping $\lambda$ em constant. measured at 90°.

6. Not covered this year.

7. Serine pI 5.68

    Tryptophan pI 5.89

a) Separation by cation exchange at pH 4.

    pH 4: Both a.a. are positively charged, but trp is <u>more</u> positively charged. Then the order is Ser, Trp.

b) at pH 8: Both amino acids would be ⊖ charged, so no interaction with stationary phase (repulsion)

8. a) The swelling factor is $\frac{1.2}{0.8} = 1.5$

If $V_t = 50\,mL$, the dry resin occupied $\frac{50}{1.5} = 33.3\,mL$

$\Rightarrow V_m = V_t - 33.3\,mL = 16.67\,mL.$

b) $V_0 = $ void volume $\cong 5.5\,mL$

$V_m = V_s + V_0 \Rightarrow V_s = V_m - V_0 = 16.67\,mL - 5.5\,mL = 11.2\,mL$

9. not covered this year

10. a) More sensitive: the intensity of the incident light is not interfering in the measurement as it is done at $90°$. $\Rightarrow$ less background noise.

More selective: Each compound that fluoresces has an optimal pair of $\lambda_{em}$, $\lambda_{exc}$ allowing for their detection.

b) i) less universal than UV, compounds may be missed.
ii) Not all compounds fluoresce, eventhough they absorb in the UV-vis.