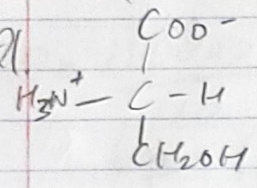
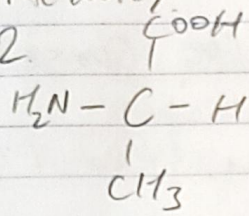
Ch 3 In Class Activity

Q1.



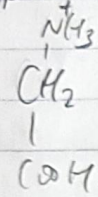
Q2



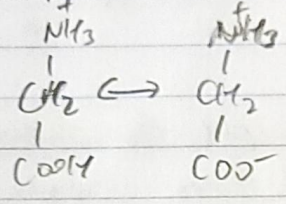
L form

Q4.

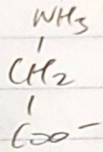
pH 1



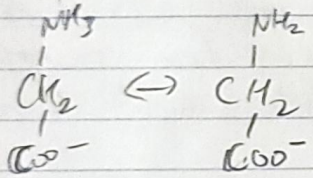
pH 2.34



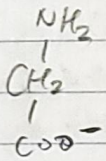
pH 5.97



pH 9.60

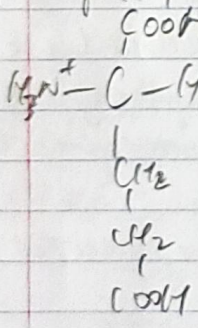


pH 11.0

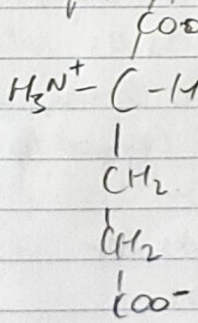


Q5.

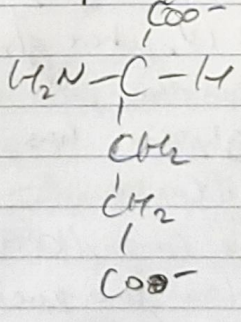
pH 1



pH 7.4

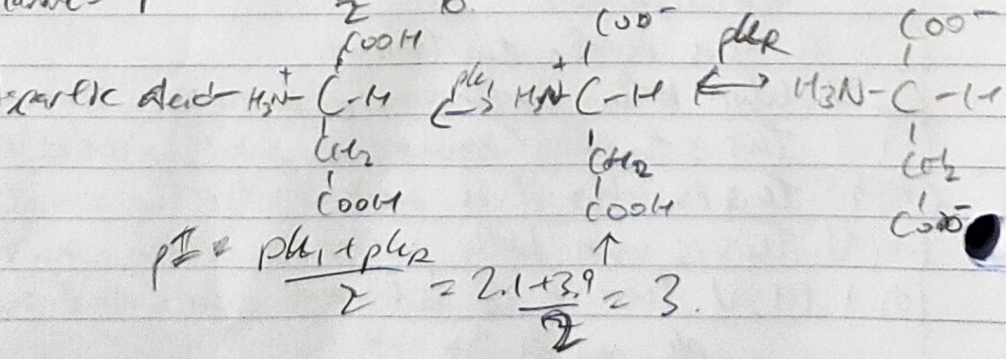


pH 11



Q6 Alanine- $pI = \frac{2.3+9.7}{2} = 6$

Aspartic acid-



$pI = \frac{pk_1 + pk_2}{2} = \frac{2.1+3.9}{2} = 3$

Q7. B, a net positive charge.

Q8. 2 Gly, 1 Leu, 1 Phe, 1 Tyr

Tyr – Gly – Gly – Phe – Leu

Q9. (a) I. At the lowest pH, the amino acid will be in the most protonated form.

(b) II. The glycine is half converted from the +1 fully protonated form to the zwitterion, so the charge is 0.5.

(c) IV. At this point, half the species have been converted to the completely deprotonated form, which deprotonates the amino group.

(d) II. This is the pK_1, which is the pK_a of the carboxyl group.

(e) IV. This is the pK_2, which is the pK_a of the amino group.

(f) II and IV, where glycine acts as both acid and base around the pK_a of the carboxyl and amino groups.

(g) III. glycine has been completely converted to the zwitterion.

(h) III. The carboxylic acid has been completely converted to form the zwitterion.

(i) V. Both hydrogens have been deprotonated off the amino acid.

(j) III. This is the zwitterion.

(k) V. When both protons are deprotonated, the charge is -1.

(l) II. This is the first equivalence point, by definition.

(m) III. This is when it is predominately the zwitterion.

(n) V. This is when both protons have been completely deprotonated.

(o) I, III, V. There is no buffering power far from the pK_1 and pK_2.

Q10. a. $\frac{110020}{110} = 1000$. This protein has 1000 amino acids.

b. Lys - $C_6H_{14}N_2O_2$ - 146.190 g/mol

$\frac{146.190 \times 10}{10.5\%} = 13922$ g/mol = Molar mass of ribonuclease.

Q11. (a) size-exclusion chromatography
(b) ion-exchange
(c) separation by affinity to RNA.

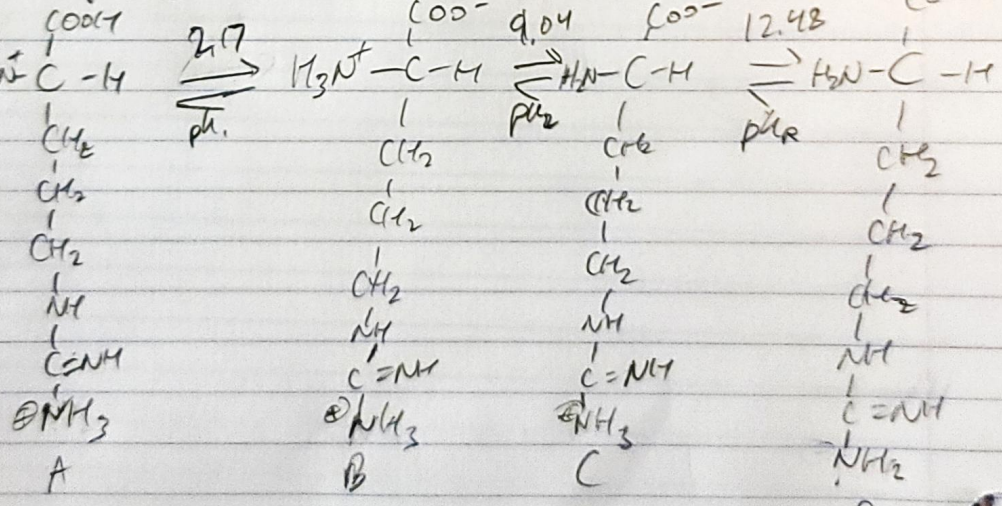
Q12 2Ala, 1Leu, 1Phe, 1Tyr, 1Trp.

Tyr-Phe-Ala-Ala-Trp-Leu

(b) Tyr-Ala-Ala-Trp-Phe-Leu (also possible)

Q13 (a) Asp (b) Met (c) Glu (d) Gly (e) Ser

Q14



(b) 1: A 9.04: B ⇌ C 14: D

(c) E (d) $\frac{9.04 + 12.48}{2} = 10.76$

Q15 a. 1. 4000000/20000 = 200
2. 3000000/5000 = 600
3. 1000000/4000 = 250
4. 800000/200 = 4000
5. 750000/50 = 15000
6. 675000/45 = 15000

b. Ion exchange chromatography was the most effective.
c. precipitation (dri) was the least effective.
d. An indication is no improvement after does size-exclusion chromatography. You can run an SDS PAGE to check the purity of the substance and ensure only one band shows up.