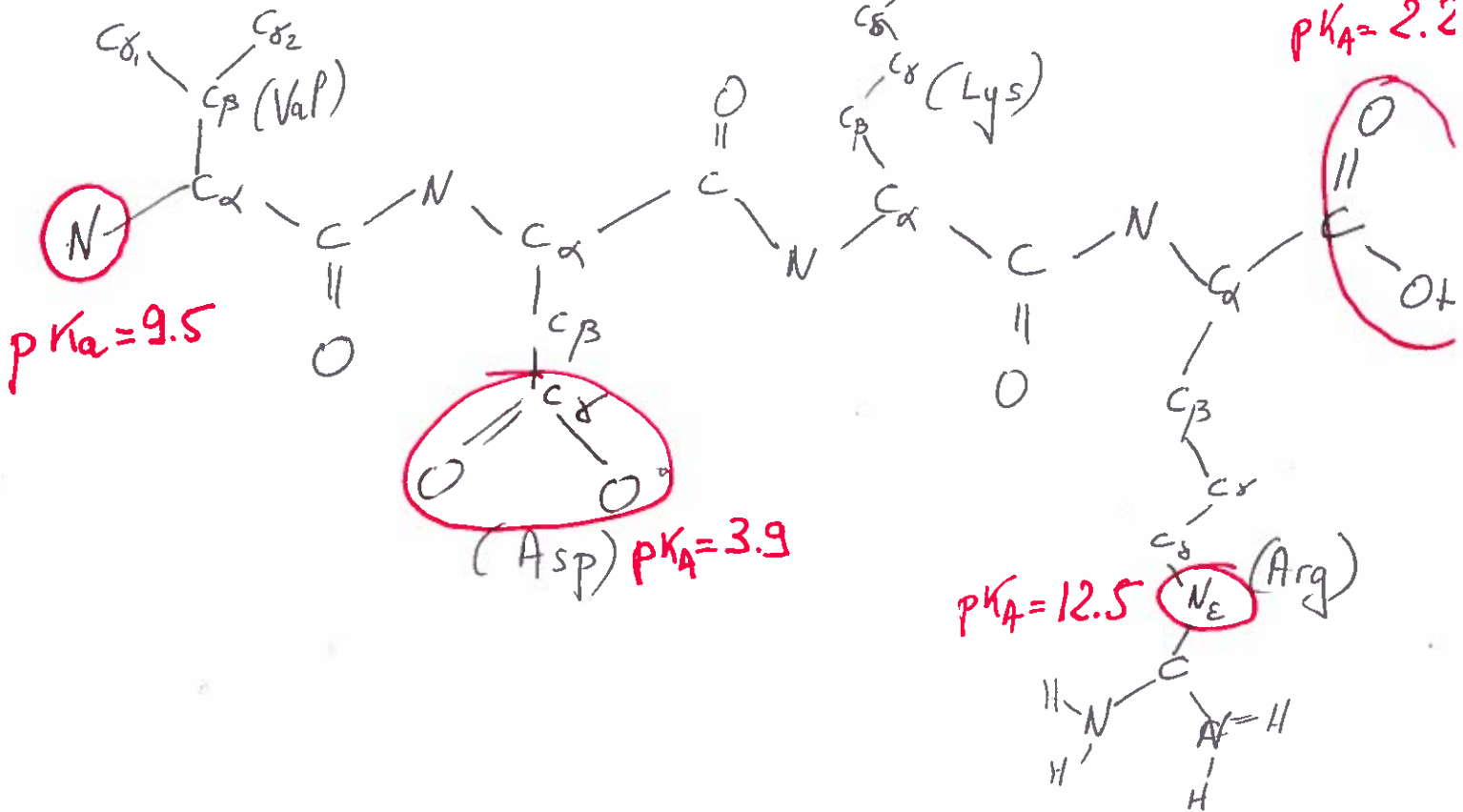


Chapter 4: Proteins

Answers to questions 8-11

The peptide considered is: $\text{N}^{\ominus} \text{pK}_a = 9.2$

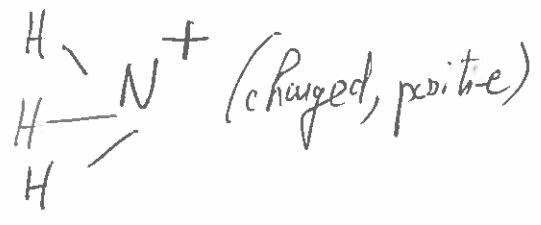


Notes:

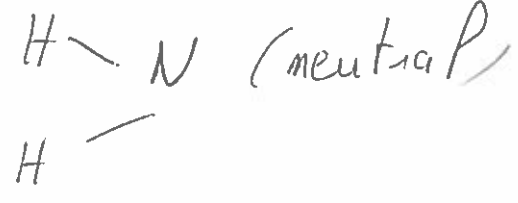
- The sequence of this peptide is Val Asp Lys Arg, or VDKR, it is in fact the peptide in question 7
- There are 5 "titratable" groups in that peptide, i.e. 5 groups whose charge depends on pH, based on their pK_a ; we will look at these 5 groups separately.

Group 1: N terminal

pH < 9.5 pKa = 9.5

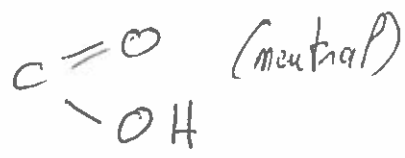


pH > 9.5



Group 2: Aspartic acid sidechain

pH < 3.9 pKa = 3.9

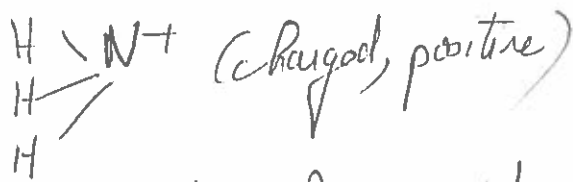


pH > 3.9

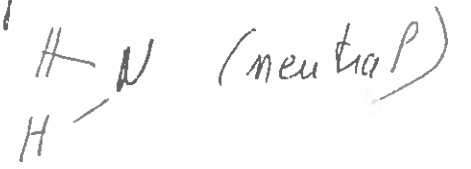


Group 3: N at the end of Lys sidechain

pH < 9.2 pKa = 9.2

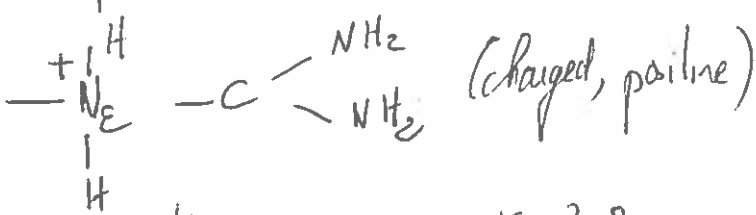


pH > 9.2

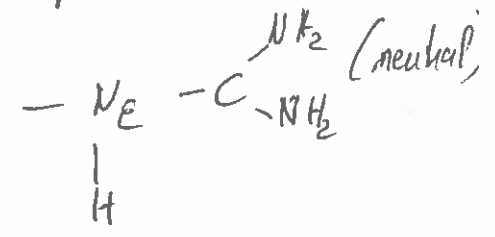


Group 4: NE in Arg sidechain

pH < 12.5 pKa = 12.5

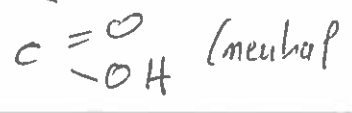


pH > 12.5

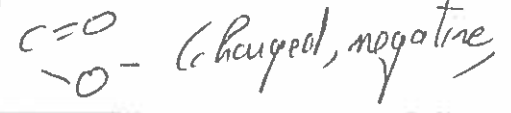


Group 5: C ter pKa = 2.2

pH < 2.2



pH > 2.2



We summarize this information in a table

pH:	0	2.2	3.9	9.2	9.5	12.5
Group 1	+	+	+	+	0	-
Group 2	0	0	-	-	-	-
Group 3	+	+	+	0	0	0
Group 4	+	+	+	+	+	0
Group 5	0	-	-	-	-	-
Total	3(+)	2(+)	1(+)	0	1(-)	2(-)

From this table, we see that:

Question 8: at pH 1, the total charge of the peptide is +7

Question 9: at pH 7, the total charge of the peptide is +7

Question 10: at pH 10, the total charge of the peptide is -1

Question 11: the peptide becomes neutral around pH 9, therefore the isoelectric point is between pH 8 and pH 9.