

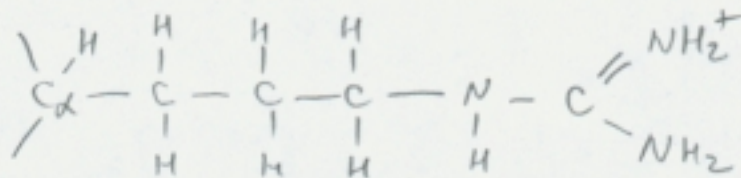
Problem 1. (20 points total, 5 points each).

Consider a short peptide with the following amino acid sequence: GQEMHR.

(a) Write the sequence of this peptide using the 3-letter abbreviations for the amino acids.

Gly - Gln - Glu - Met - His - Arg

(b) Draw the structure of the **side chain** (R-group) of the C-terminal residue (the residue at the carboxyl terminus) of this polypeptide at pH 7.0? Indicate charges, if any.



(c) Indicate the total charge (in the units of electron charge) of the predominant species in solution with the following pH values:

pH = 5.0: $\frac{+1}{}$

pH = 7.0: $\frac{0}{}$

pH = 11.0: $\frac{-1}{}$

pH = 14.0: $\frac{-2}{}$

(d) Determine the isoelectric point (pI) for this peptide.

$$pI = \frac{pK_R(\text{His}) + pK_{a2}(\text{NH}_3)}{2} = \frac{6.0 + 9.6}{2} = 7.8$$