CONCEPT: TITRATIONS OF AMINO ACIDS WITH NON-IONIZABLE R-GROUPS

●All amino acids are _____ acids (multiple acidic hydrogens) with *multiple* pK_a values.

□ _____ points (or *midpoints*) correspond to each _____ value.

□ _____ points (or *endpoints*) represent the point of *neutralization* of an acid.

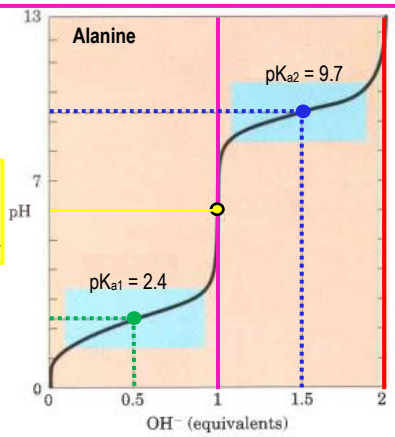
EXAMPLE: Titration Curve Review.

What does the **pink** line represent?
_____ point of _____ group. (No more COOH).

What do the **blue** dot & lines represent?
_____ & pK_a of _____ group.

What do the **yellow** dot & line represent?
_____ point (pI). Ala's net charge = ___

What do the **green** dot & lines represent?
_____ & pK_a of _____ group.



What do the **light blue** boxes represent?
Effective _____ ranges.
(±1 of pK_a).

What does the **red** line represent?
_____ point of _____ group.
(No more NH_3^+).

What does the **black** curve represent?
_____ titration curve.

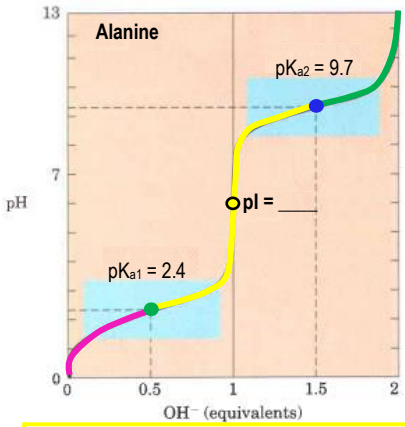
Drawing Amino Acids with Nonionizable R-Groups from Titration Curves

●For all amino acids with *non*-ionizable R-groups: 1) the pI is found at the _____ group equivalence point.

2) Titration curves only have ___ inflection/equivalence points.

EXAMPLE: Draw the predominate structure of Ala at each colored region of its titration curve and calculate its pI.

Net Charge = _____



Net Charge = _____

Net Charge at pK_{a1} ● = _____

Net Charge at pK_{a2} ● = _____

Net Charge = _____

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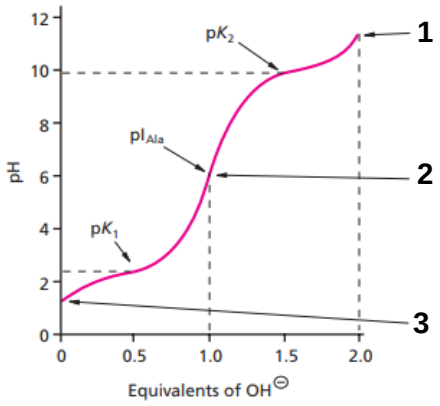
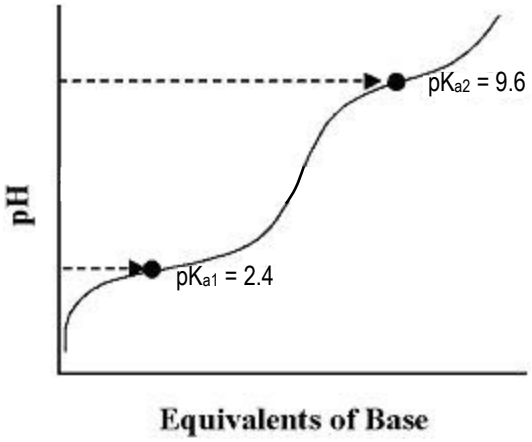
PRACTICE: Draw the predominate structures of Leu at each of the indicated sections (**1**, **2**, **3**) on its titration curve.



Structure 1 Structure 2 Structure 3

PRACTICE: Calculate the pI of Ile using its titration curve. Mark the approximate position of the pI on the titration curve.



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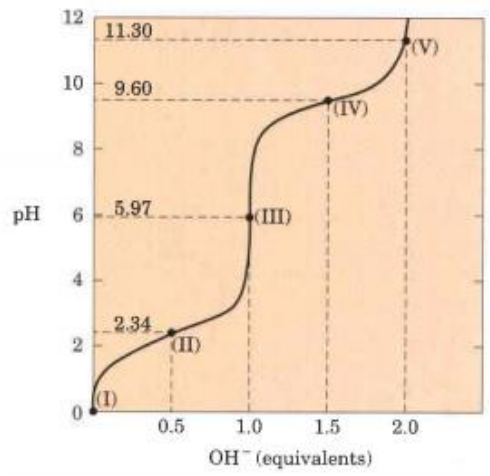
PRACTICE: Identify the region(s) on glycine's titration (I, II, III, IV, or V) that corresponds with each statement below:



a) Region where Gly predominant species has net charge of +1. _____

b) Region where the average net charge of Gly is +½. _____

c) Region where ½ of Gly's amino groups are ionized. _____

d) Region where the pH = pK_a of carboxyl group. _____

e) Region where the pH = pK_a of amino group. _____

f) Regions where Gly has its maximum buffering capacity. _____

g) Region where the average net charge of Gly is 0. _____

h) Region where Gly's carboxyl group has been completely titrated. _____

i) Region where Gly has been completely titrated. _____

j) Region where Gly's predominant species is a zwitterion. _____

k) Region where the average net charge of Gly is -1. _____

l) Region where Gly is a 50:50 mixture of protonated & deprotonated carboxyl group. _____

m) Region indicating Gly's isoelectric point (pI). _____

n) Region indicating the end of Gly's titration. _____

o) Regions where Gly has poor buffering power. _____