Proteins 2

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2nd year undergraduate – Biology

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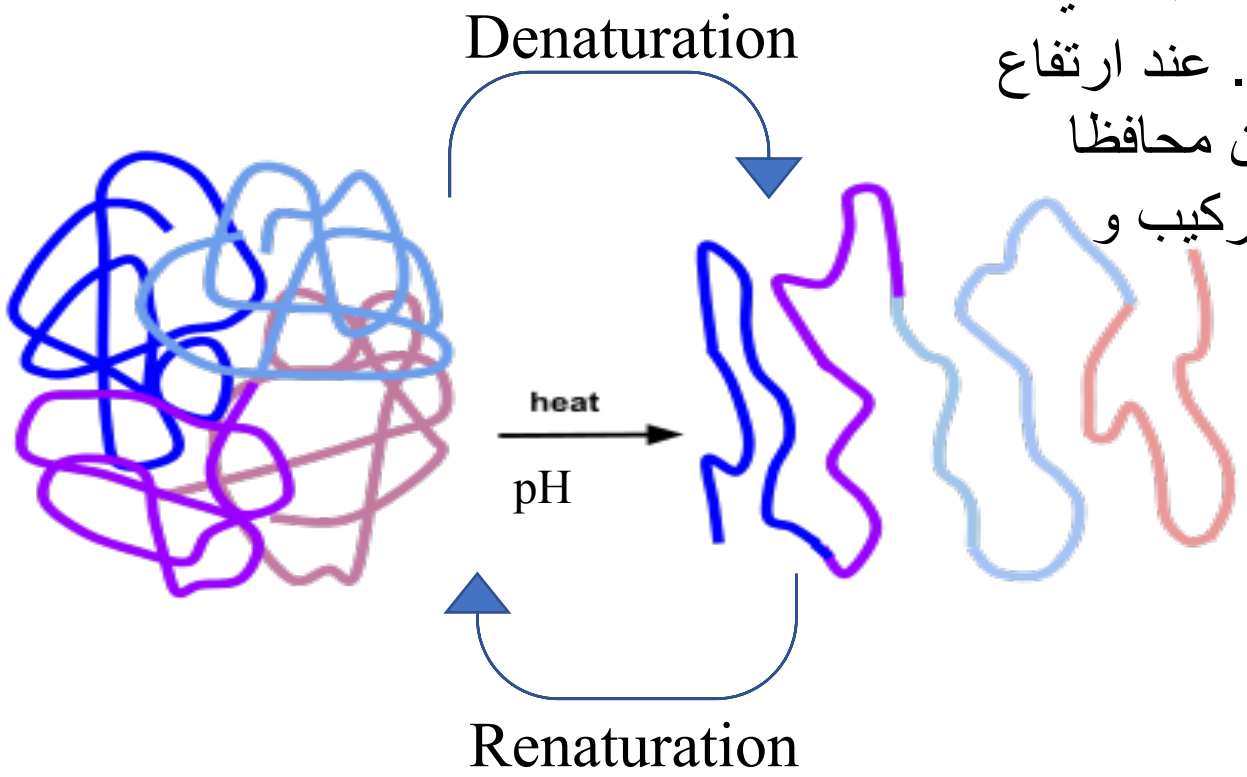
Denaturation of proteins

1- Heat: weak interactions : hydrogen bonds + van der Waals bonds) = a gradual misfolding of the protein into its secondary or primary structure, proteins



تمسخ البروتينات

عند تغير الظروف المحيطه بالجزيئه البرةتينيه ستحدث تغييرات على تركيب البروتين بحيث يفقد التركيب ثلاثي الابعاد و بالتالي يفقد وظيفته. هذا التغير بالتركيب والوظيفه يسمى التمسخ البروتيني.

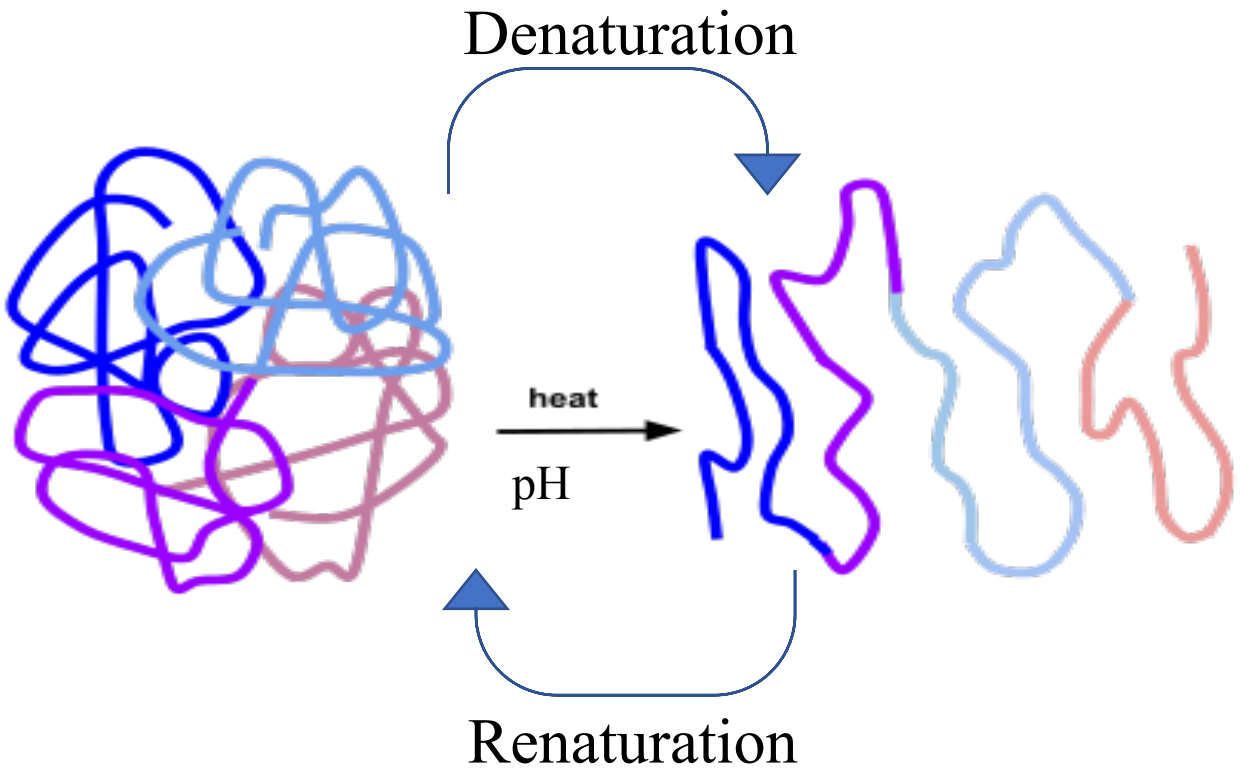
تتمسخ البروتينات بواسطه:

- **الحراره**: تؤثر على التاصرات الضعيفه وعلى الاصره الهيدروجينيه. عند ارتفاع درجه الحراره يبقى البروتين محافظا على شكله الى ان يتكسر التركيب و عندها يتمسخ.

Denaturation of proteins

2- pH: Proteins can also be misfolded by extreme pH, where the net charge on the protein will be changed, = an electrostatic repulsion + disruption of some hydrogen bonding + S-S bonding.

:pH
ارتفاع او انخفاض التركيز الهيدروجيني يؤثر على صافي الشحنه على الجزيئه البروتينيه مما يغيرطبيعه التاصر الايوني وبالتالي الى التنافر بدلا من التاصر

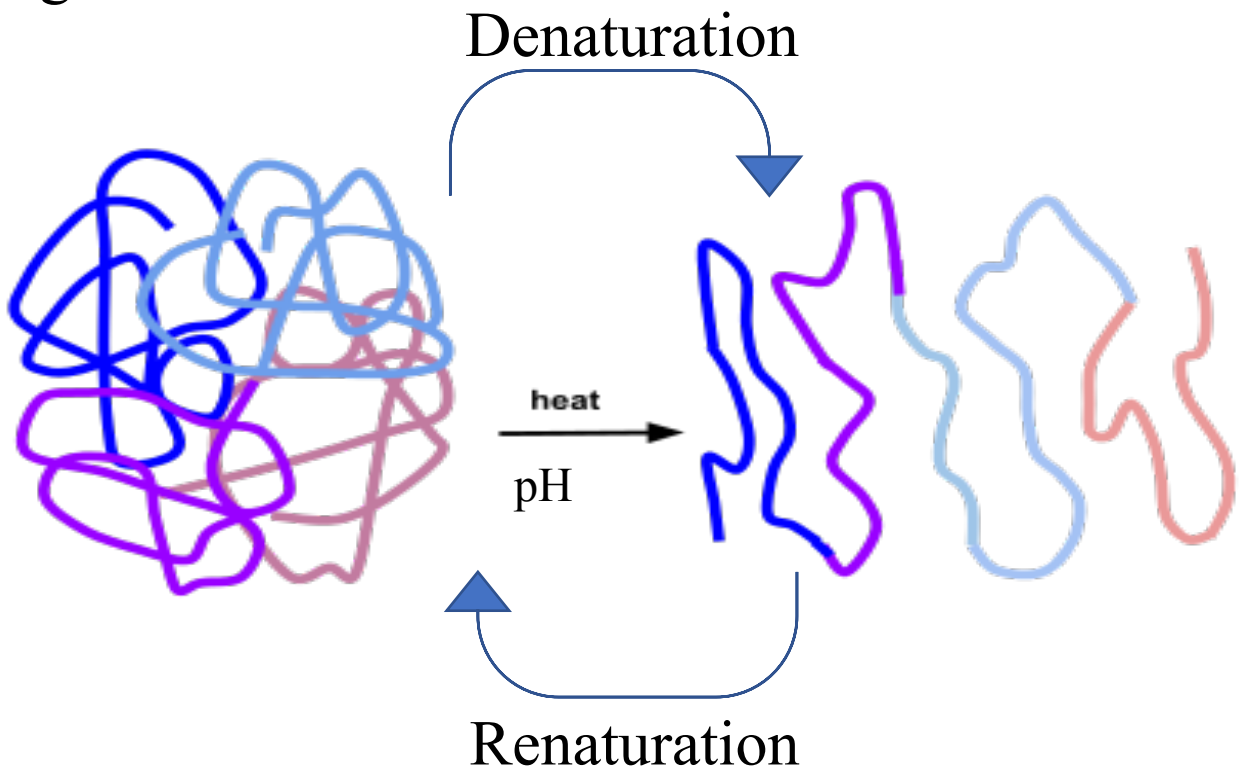


Denaturation of proteins

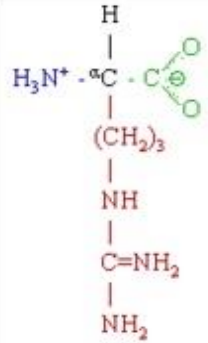
3- Organic solvents such as alcohol or acetone, or detergents = disrupting of the hydrophobic interactions + precipitation of the protein.

المذيبات لعضويه:
تؤثر اليوريا والمنظفات على الاواصر الكارهه للماء و تكسرها وهذا يزعزع جوهر البروتين.

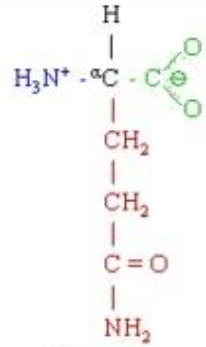
Some protein could retain its structure and function by removing the denaturation agent and the process is called "renaturation".



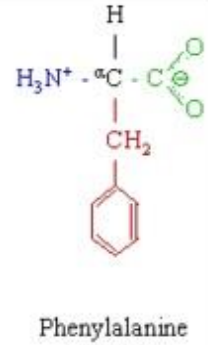
Q: Draw the peptide (Ser- Ala-Gln-Glu) and show the peptide bond and the N- and C- terminus.



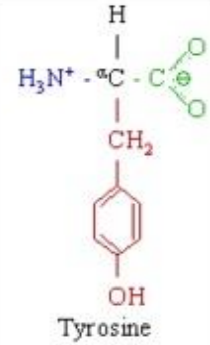
Arginine
(Arg / R)



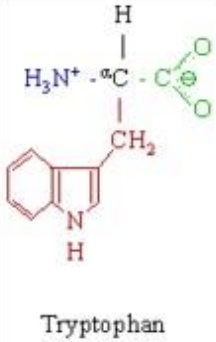
Glutamine
(Gln / Q)



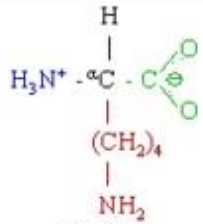
Phenylalanine
(Phe / F)



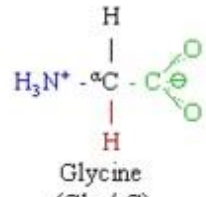
Tyrosine
(Tyr / Y)



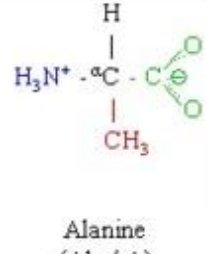
Tryptophan
(Trp, W)



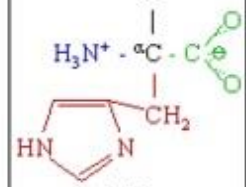
Lysine
(Lys / K)



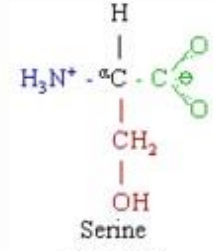
Glycine
(Gly / G)



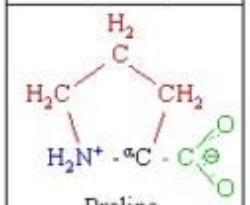
Alanine
(Ala / A)



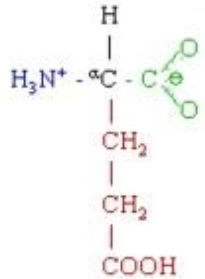
Histidine
(His / H)



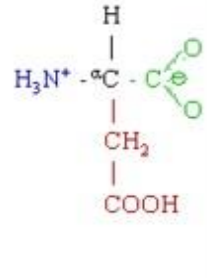
Serine
(Ser / S)



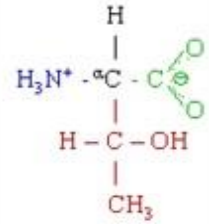
Proline
(Pro / P)



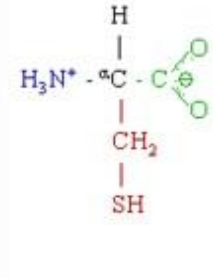
Glutamic Acid
(Glu / E)



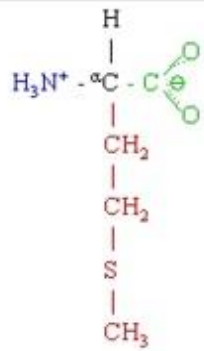
Aspartic Acid
(Asp / D)



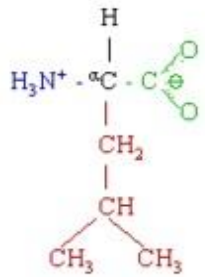
Threonine
(Thr / T)



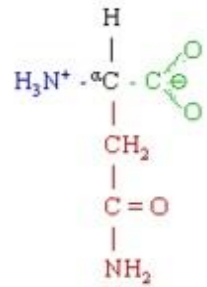
Cysteine
(Cys / C)



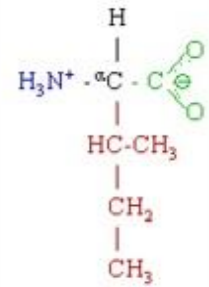
Methionine
(Met / M)



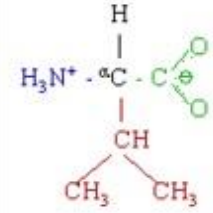
Leucine
(Leu / L)



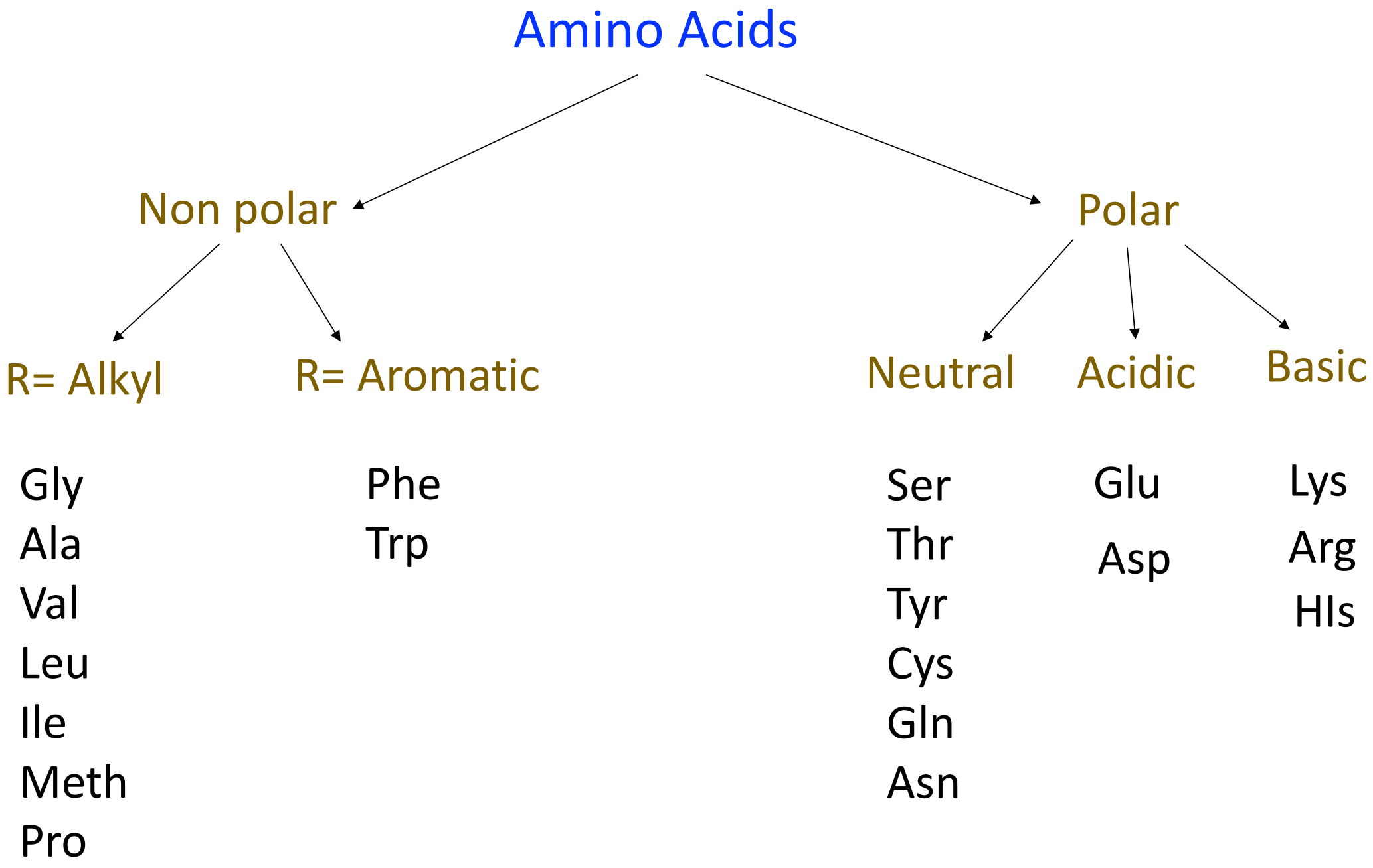
Asparagine
(Asn / N)



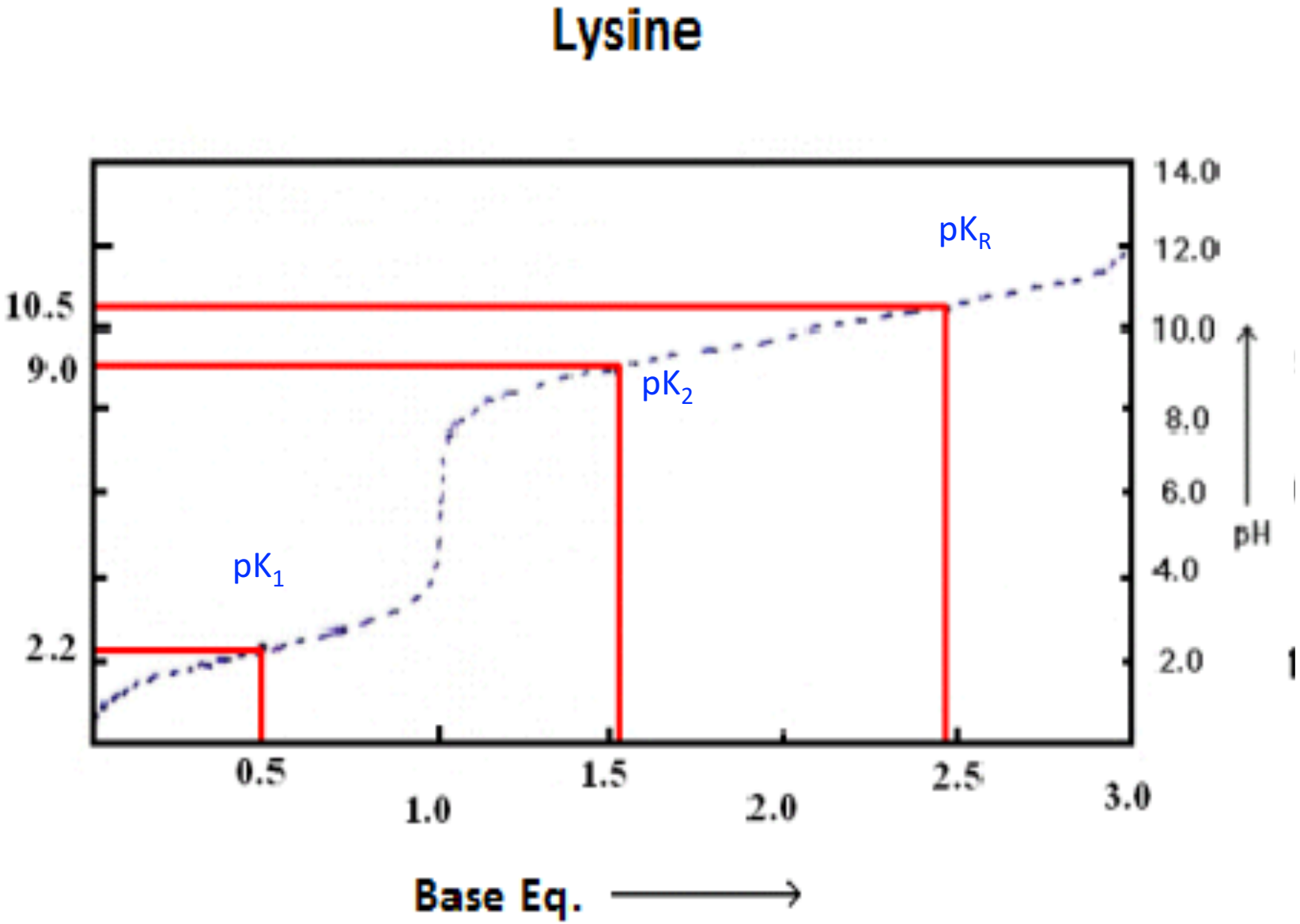
Isoleucine
(Ile / I)



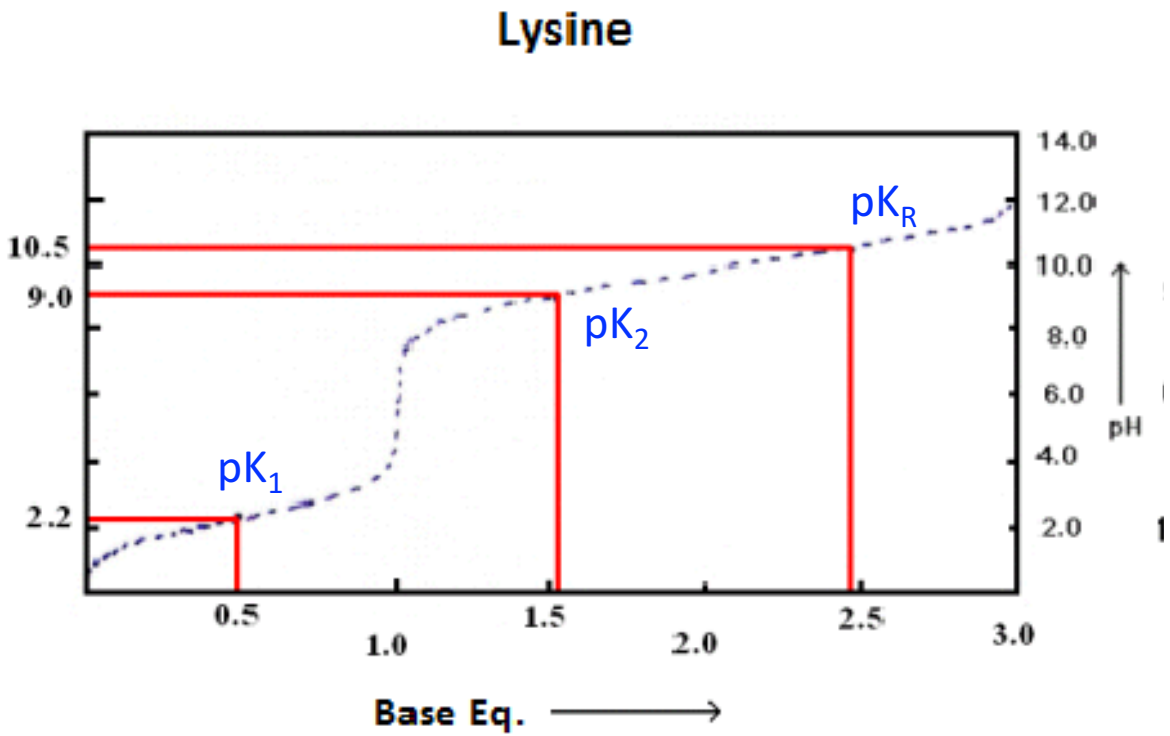
Valine
(Val / V)


Amino Acids
Non polar
Polar
R= Alkyl
R= Aromatic
Neutral
Acidic
Basic
Gly
Ala
Val
Leu
Ile
Meth
Pro
Phe
Trp
Ser
Thr
Tyr
Cys
Gln
Asn
Glu
Asp
Lys
Arg
HIs

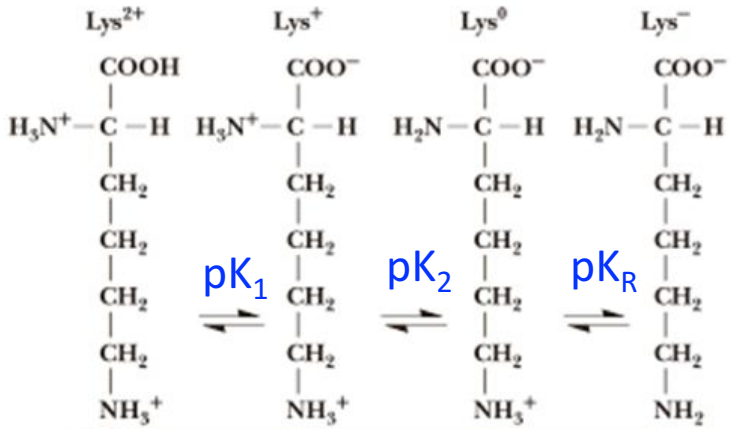
* **Find the pI from the following titration curve of Lys**



Solution

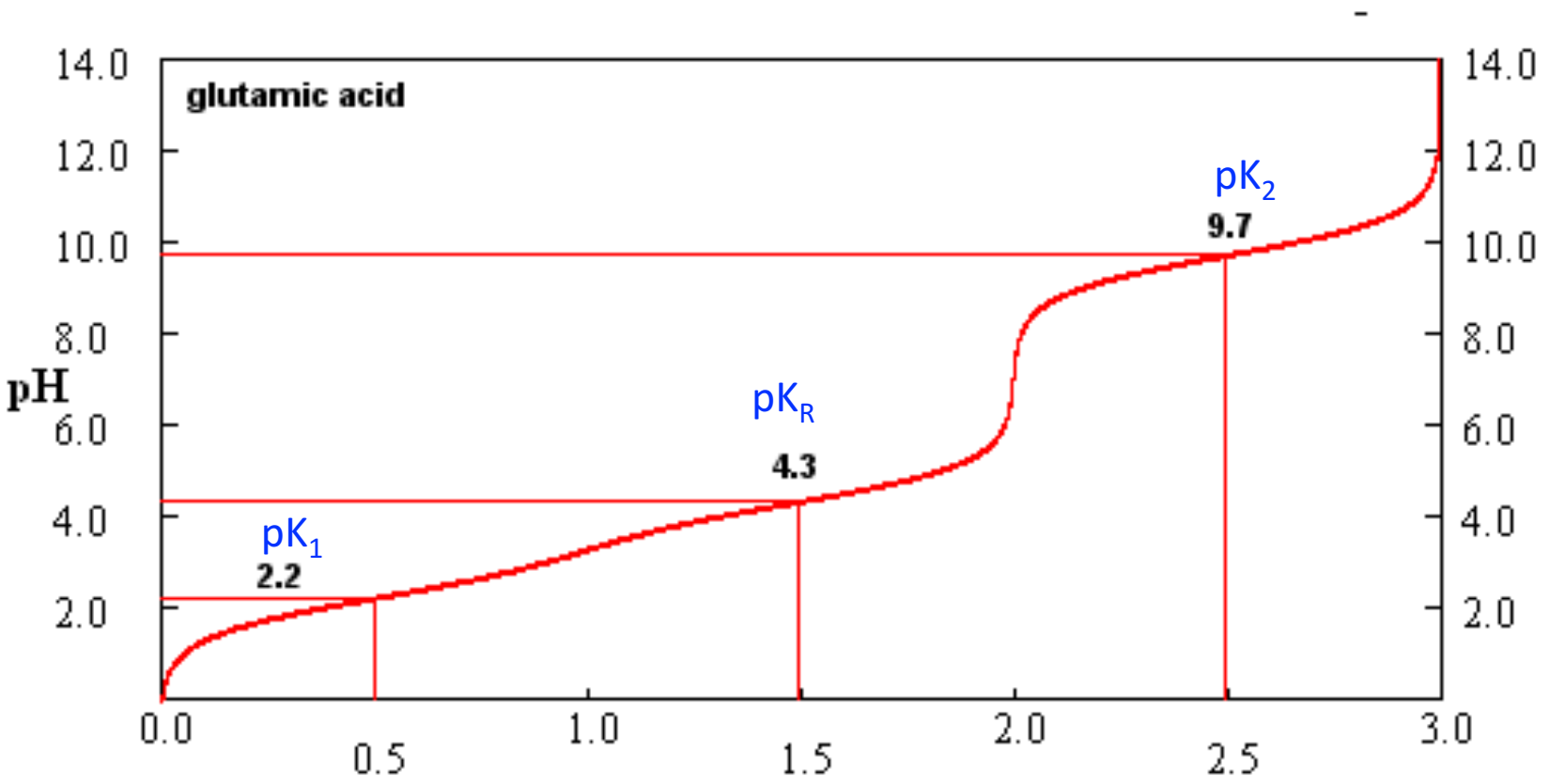


Amino acid	p*Ka*$_1$	p*Ka*$_2$	p*K*$_R$	pI
Lysine	2.18	8.95	10.53	9.74

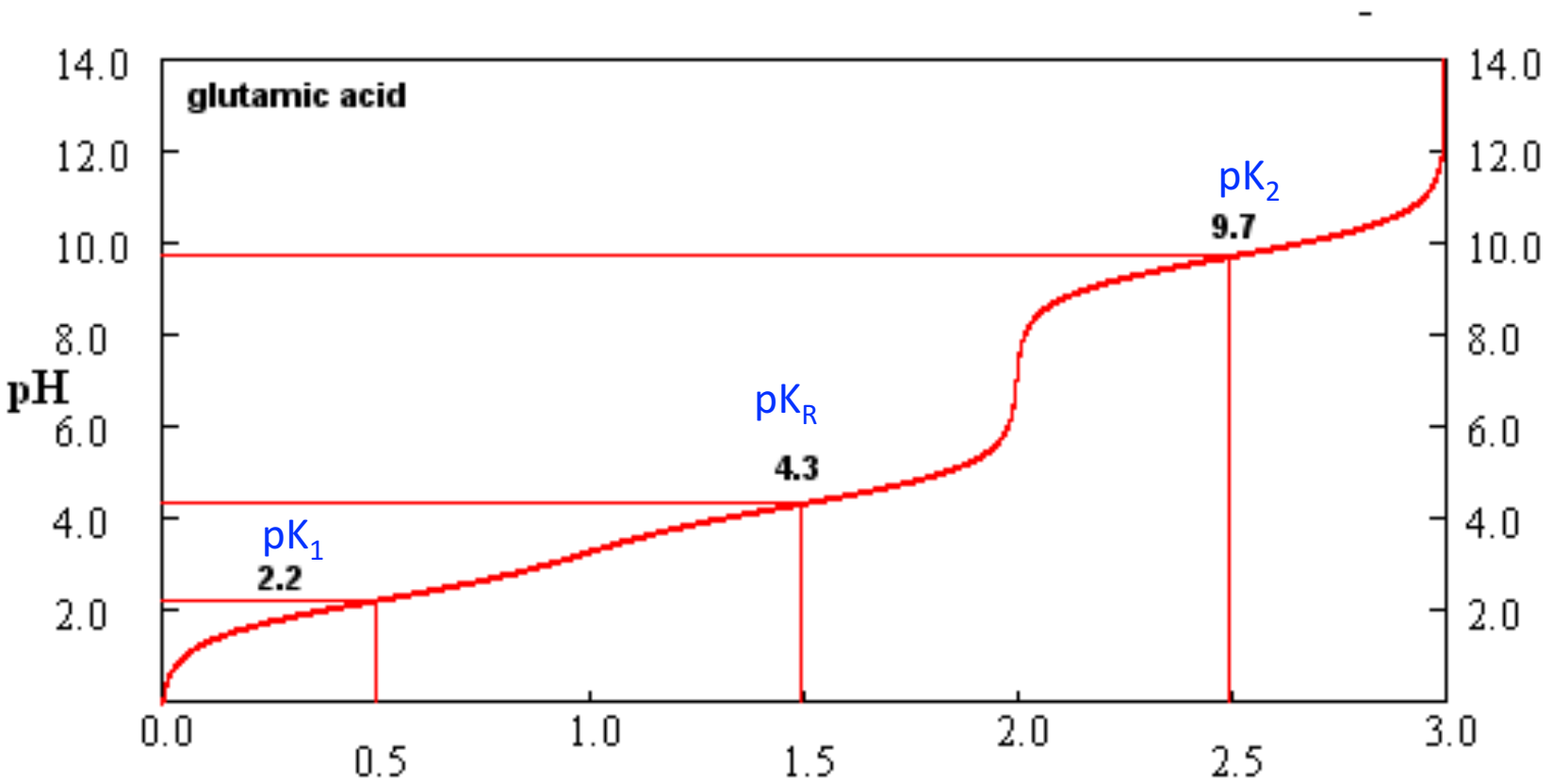


$$pI = \frac{pKa_2 + pK_R}{2}$$

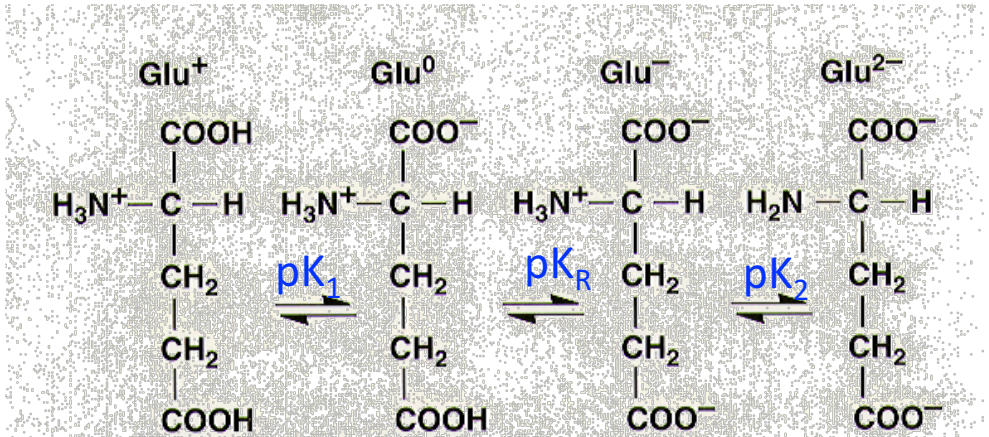
Find the pK_1, pK_2, pK_R and pI from the following titration curve of Glu



Solution



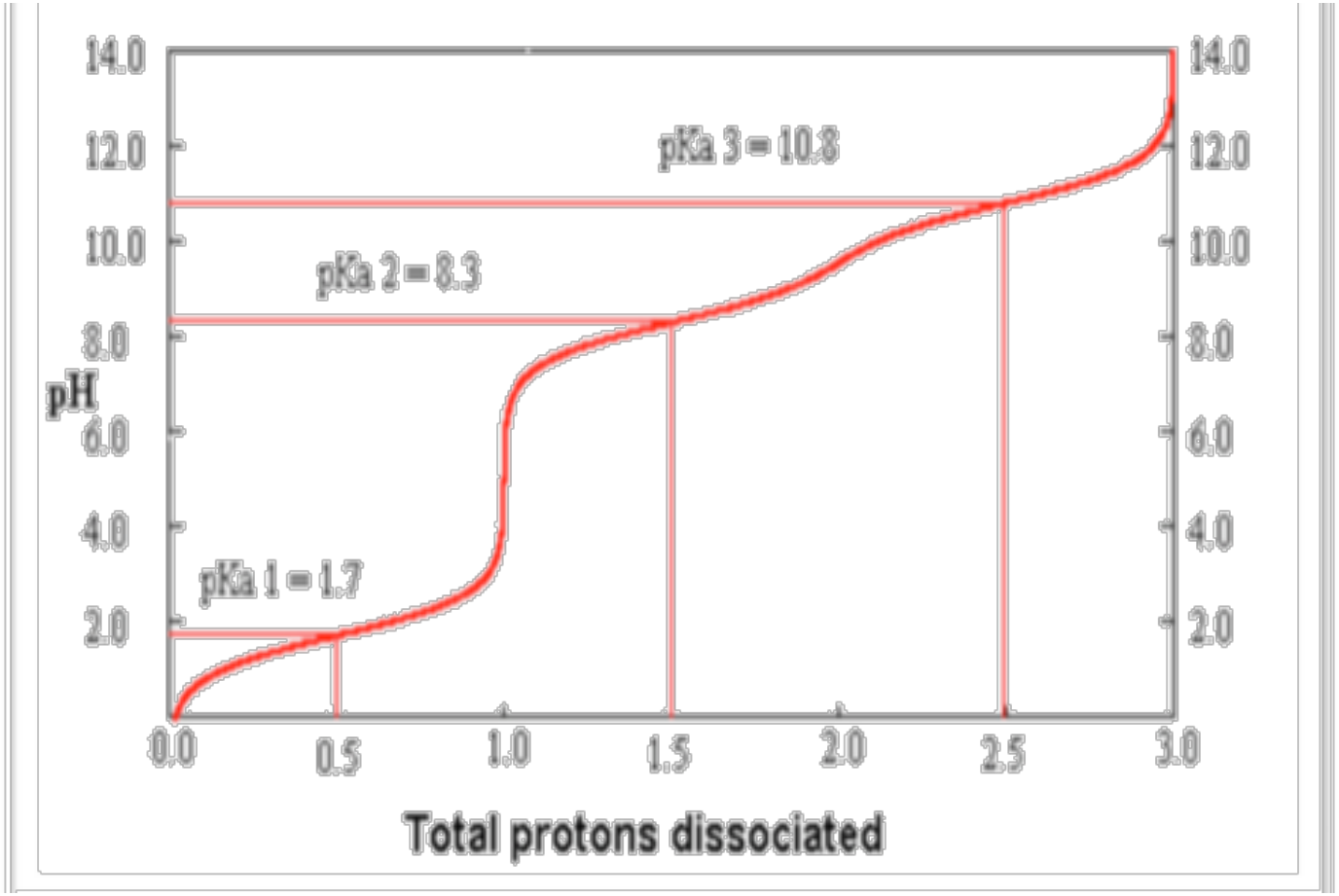
Amino acid	pKa_1	pK_R	pKa_2	pI
Glutamic acid	2.19	4.25	9.67	3.22

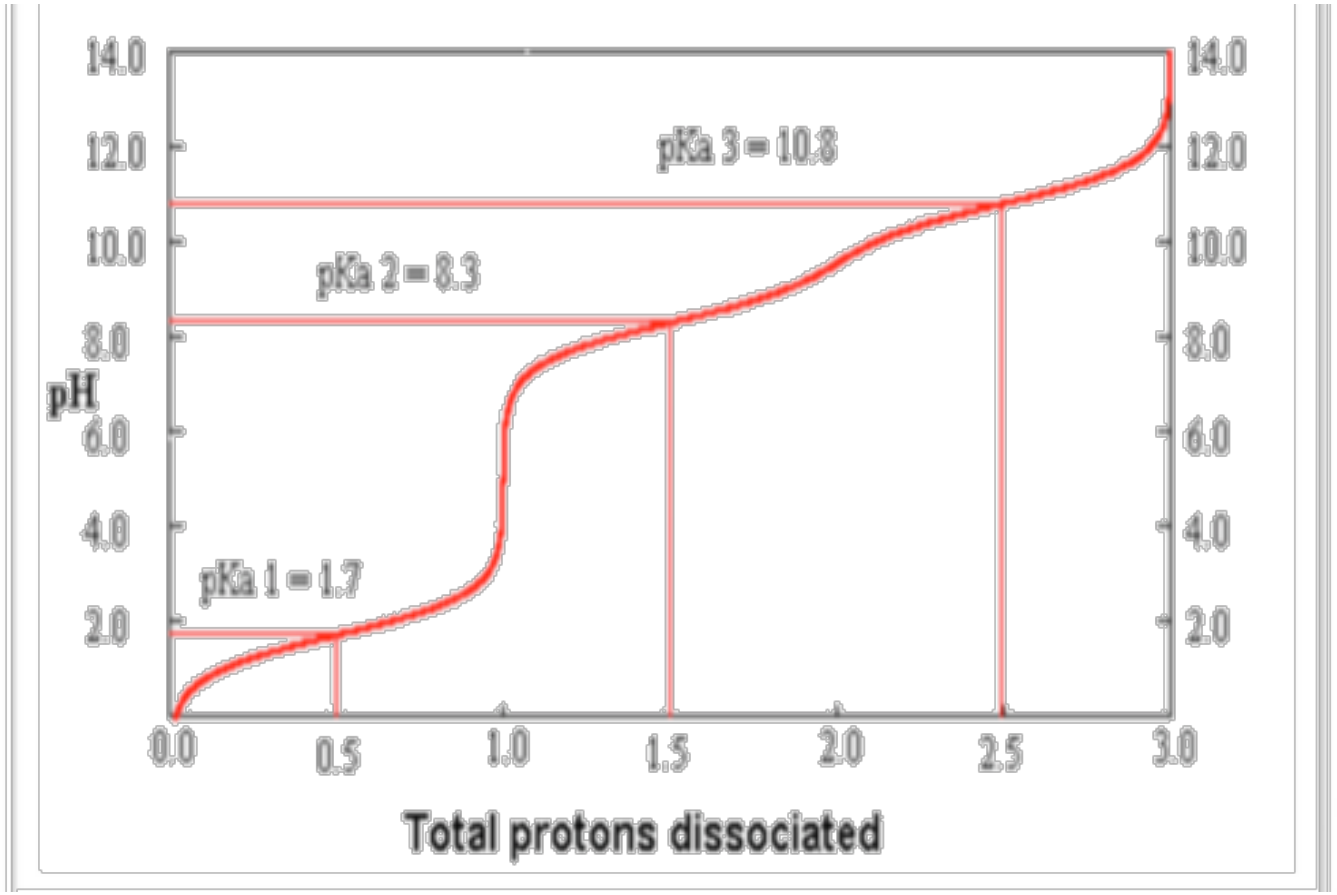


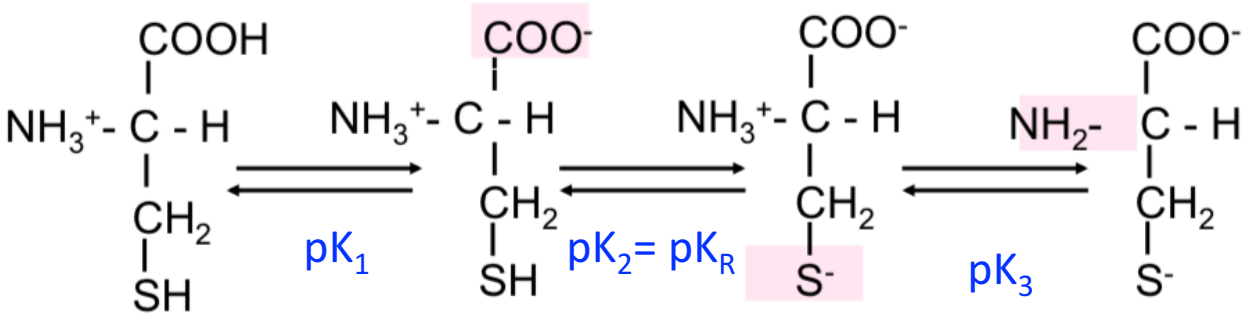
$$pI = \frac{pKa_1 + pK_R}{2}$$

Cysteine S

* **Find the pI from the following titration curve of Cys.**

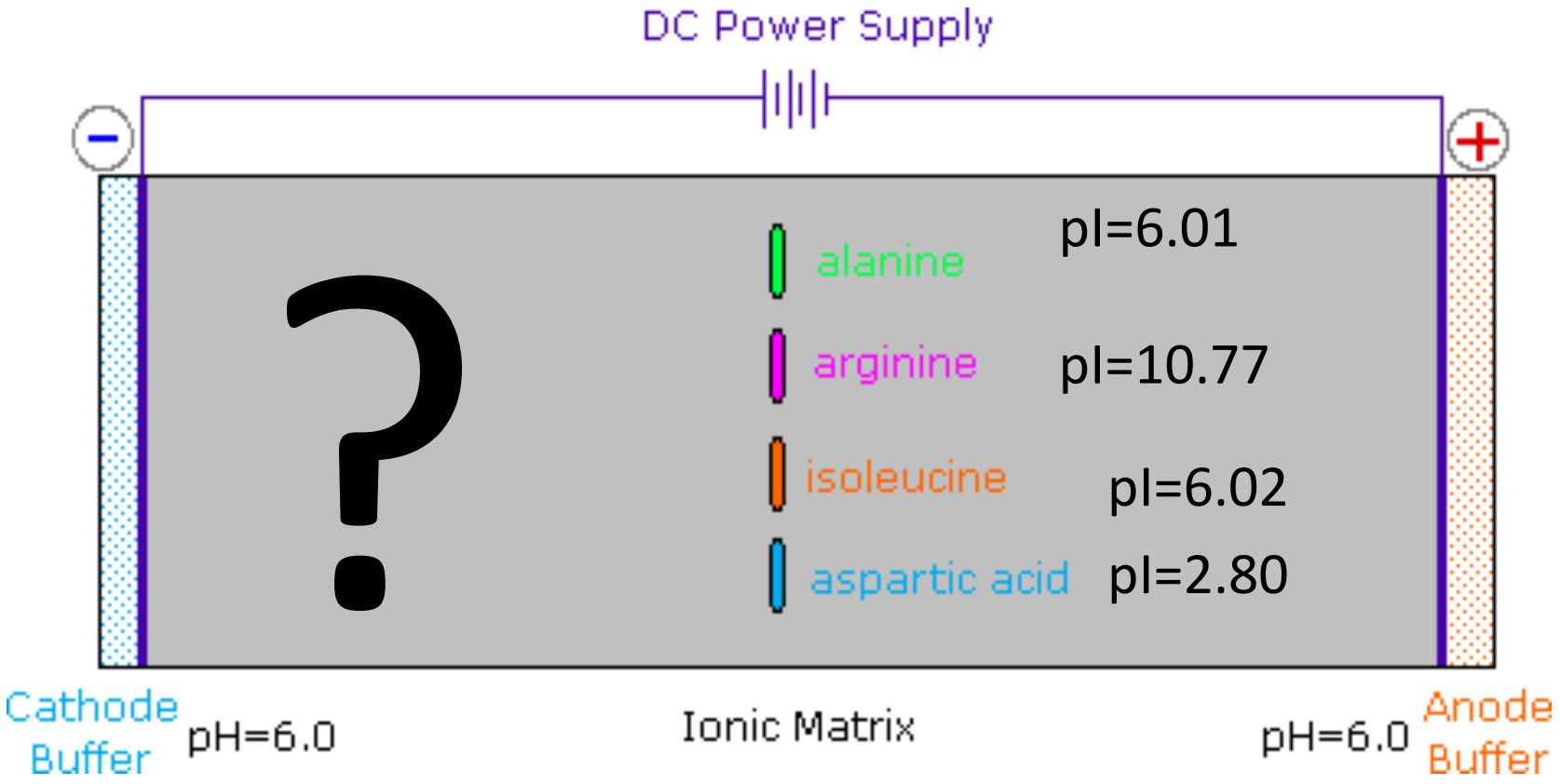






$$pI = \frac{pKa_2 + pK_3}{2}$$

Predict how the following amino acids migrate through the the gel electrophoresis?



To answer:
Think what is the net charge of Ala will be at pH 6 if its pI= 6.01?
What is the net charge of Arg will be at pH 6, if its pI = 10.77?
What is the net charge of Ile will be at pH 6, if its pI = 6.02?
What is the net charge of Asp will be at pH 6, if its pI = 2.80?