

OUTLINE

- *Reading:* McMurry 26.1-26.2 - Polyprotic Acids & pKa
 - Relationship between pKa of acids and pH of solution
 - Titration of amino acids
 - Electrophoresis

- Know the full structures & abbreviations of the common amino acids

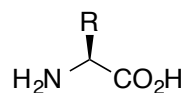
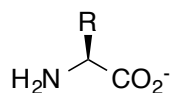
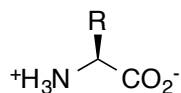
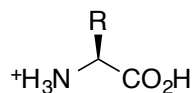
HW: Draw the ionic species for full pH range (1-14) for acidic & basic amino acids.

What is a pKa?

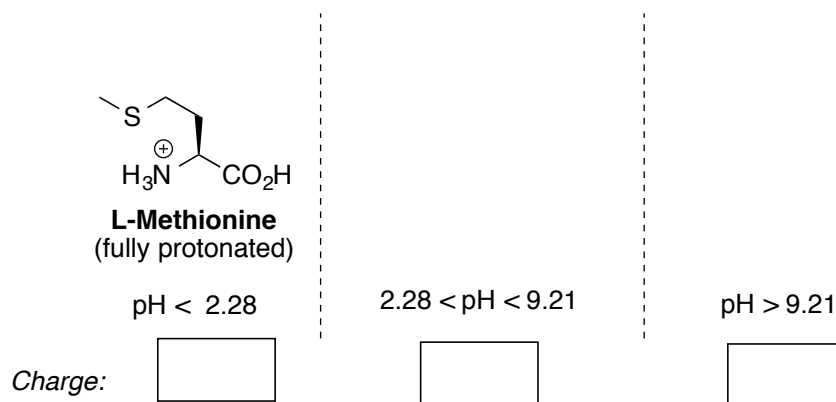
Titration of Phosphoric Acid (pKa₁ 2.1; pKa₂ 7.2; pKa₃ 12.3)

What's the charge of the *dominant* ionic phosphate species at pH 1? pH 5? pH 7.4? pH 13?

Amino Acids – which one looks weird to you?



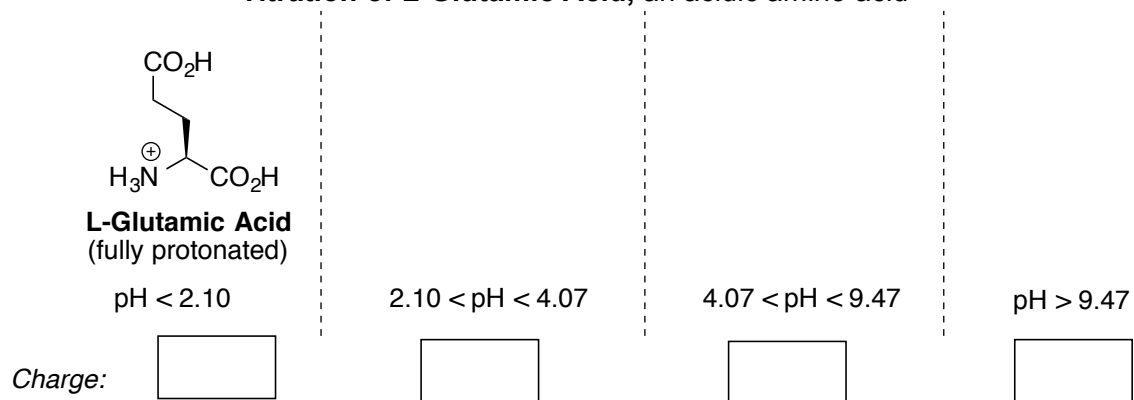
Titration of a L-Methionine, a neutral amino acid



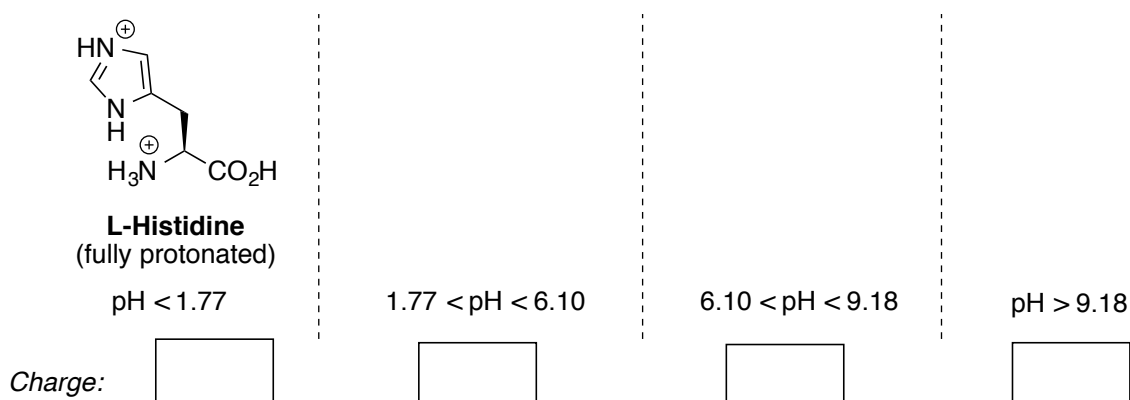
pI = Isoelectric point – pH at which the molecule is neutral (not necessary neutral @ pH 7)

- Calculate by taking the average of the 2 pKa's on either side of neutral molecule

Titration of L-Glutamic Acid, an acidic amino acid



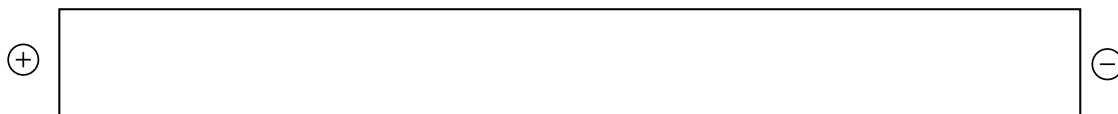
Titration of L-Histidine, an interesting basic amino acid



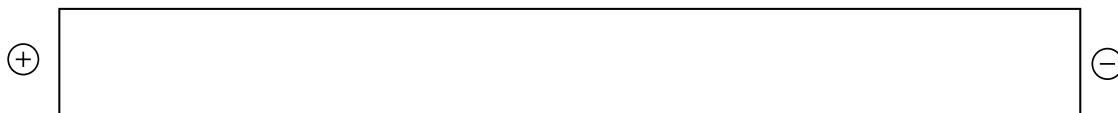
Electrophoresis – separation of amino acids based on charge.

	pH 1	pH 3	pH 5	pH 7	pH 9	pH 11
Met						
Glu						
His						
Lys						
Tyr						

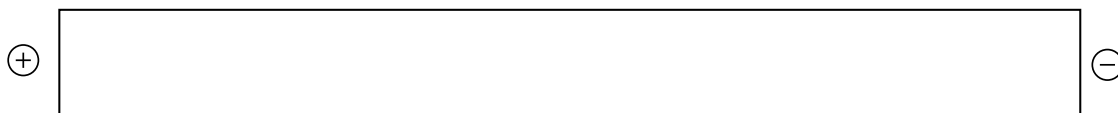
Separation @ pH 3



Separation @ pH 7

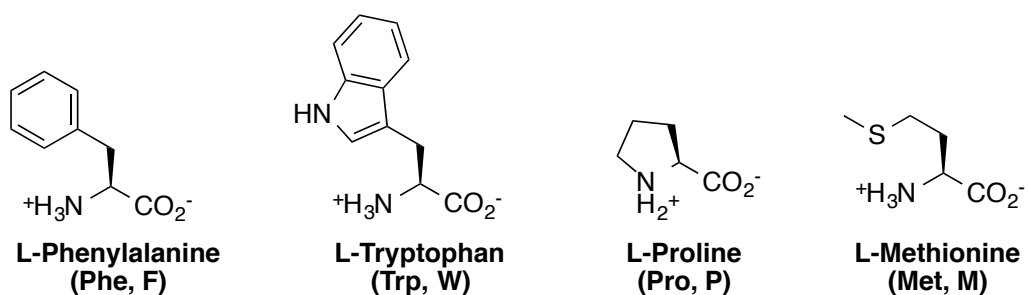
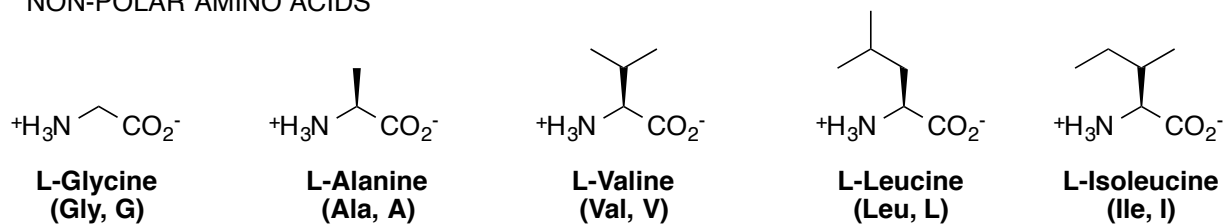


Separation @ pH 11

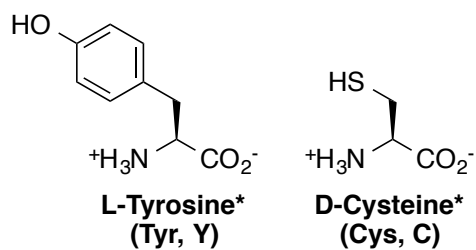
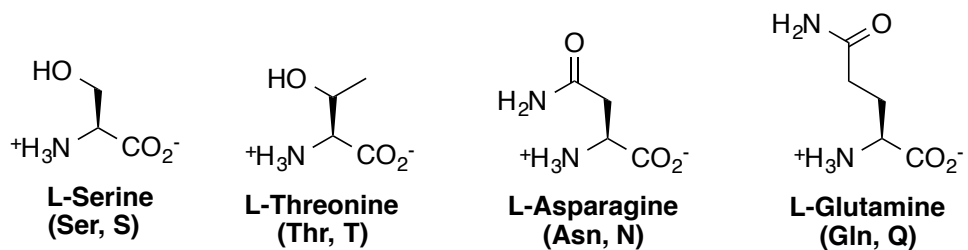


NEUTRAL AMINO ACIDS

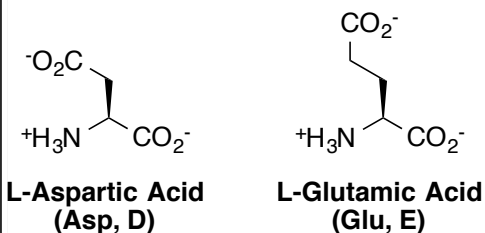
NON-POLAR AMINO ACIDS



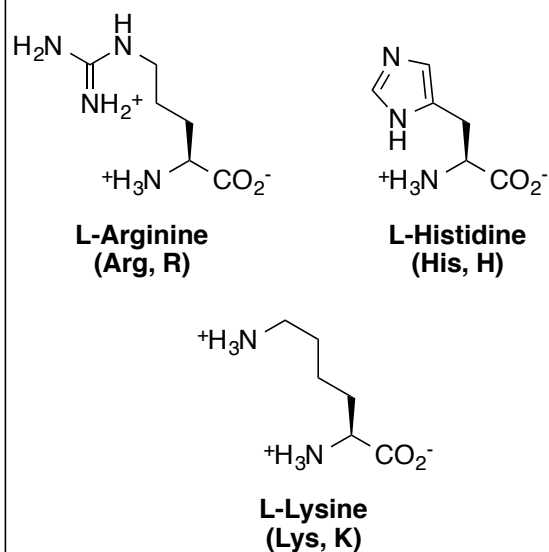
POLAR AMINO ACIDS



ACIDIC AMINO ACIDS



BASIC AMINO ACIDS



<i>pKa Values for Ionizable Groups of Amino Acids</i>				
Amino Acid	pKa₁	pKa₂	pKa_R	pI
Alanine	2.35	9.87	-	6.11
Arginine	2.01	9.04	12.48	10.76
Asparagine	2.02	8.80	-	5.41
Aspartic Acid	2.10	9.82	3.86	2.98
Cysteine	2.05	10.25	8.00	5.02
Glutamic Acid	2.10	9.47	4.07	3.08
Glutamine	2.17	9.13	-	5.65
Glycine	2.35	9.78	-	6.06
Histidine	1.77	9.18	6.10	7.64
Leucine	2.32	9.76	-	6.04
Isoleucine	2.33	9.74	-	6.04
Lysine	2.18	8.95	10.53	9.74
Methionine	2.28	9.21	-	5.74
Phenylalanine	2.58	9.24	-	5.91
Proline	2.00	10.60	-	6.30
Serine	2.21	9.15	-	5.68
Threonine	2.09	9.10	-	5.60
Tryptophan	2.38	9.39	-	5.88
Tyrosine	2.20	9.11	10.07	5.63
Valine	2.29	9.72	-	6.00

* You do not need to memorize these pKa's. You should know how to use them when given. *