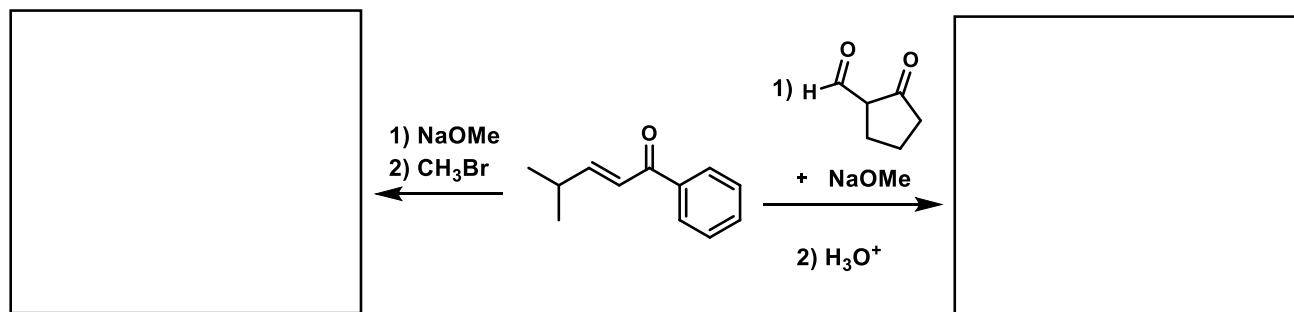
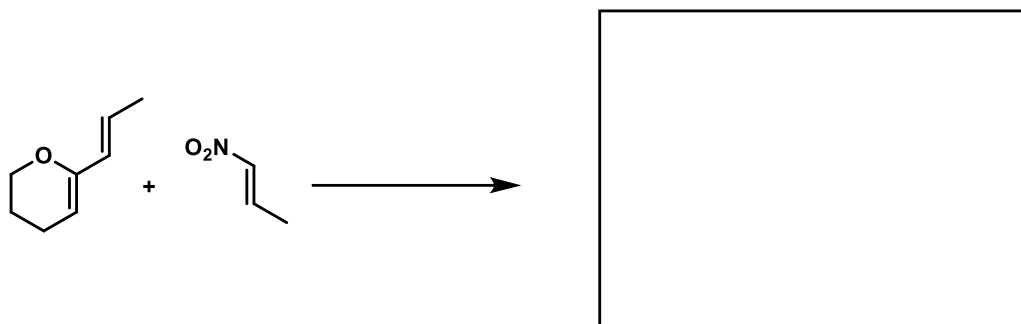
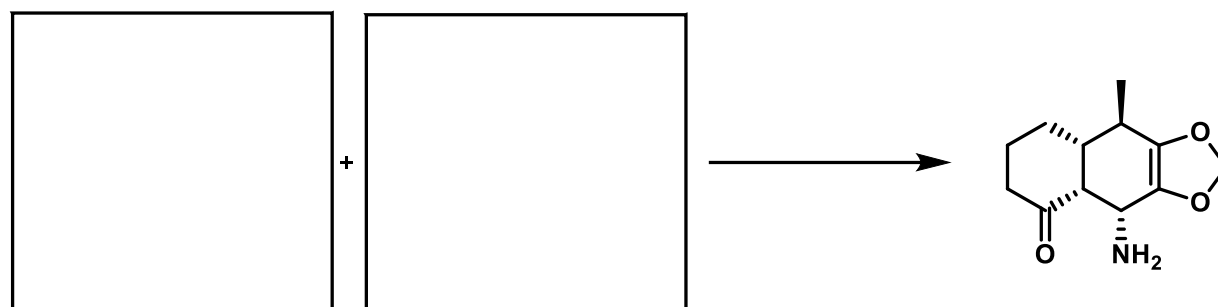


Name: _____

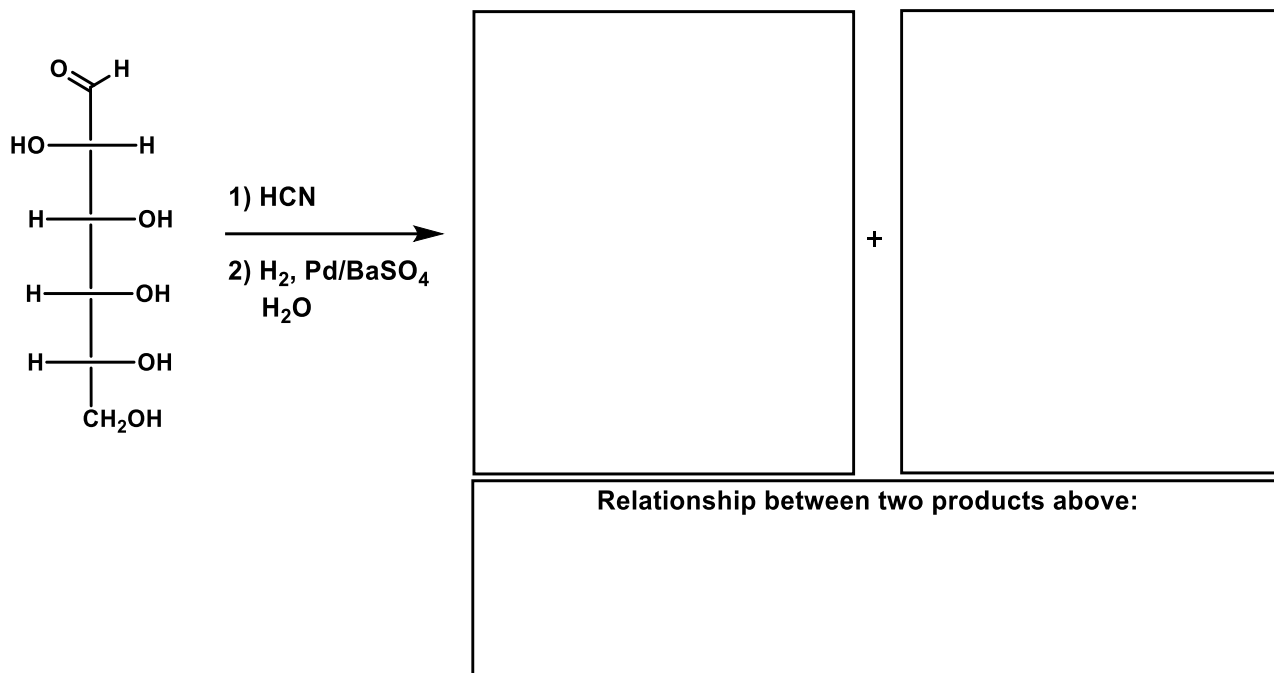
IA																				0					
1 H 1.008																		2 He 4.003							
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18								
11 Na 22.99	12 Mg 24.31	IIIB	IVB	VB	VIB	VIIIB	VIIIIB			IB	IIIB	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95								
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80								
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3								
55 Cs 132.9	56 Ba 137.3	57 * La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)								
87 Fr (223)	88 Ra (226.0)	89 ** Ac (227)	104 Rf	105 Ha	106 Unh	107 Uns	108	109 Uue																	

* 58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
*** 90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (244)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

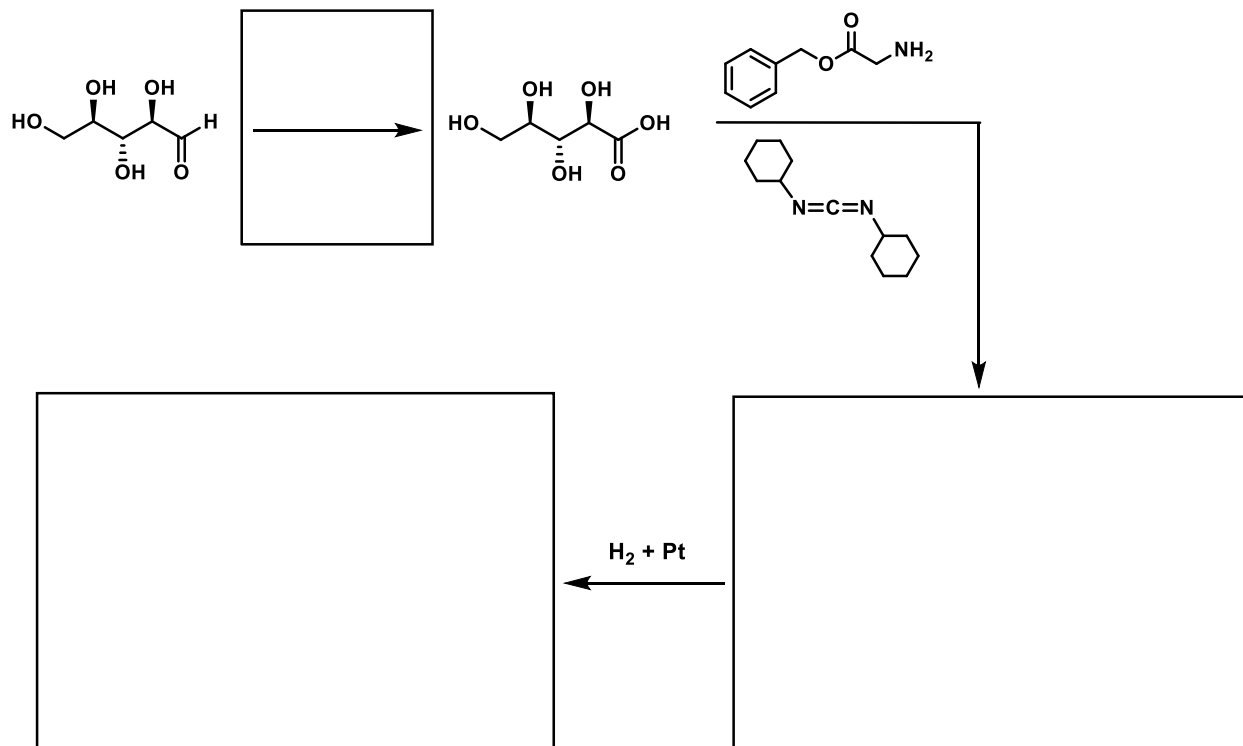
1. Fill in each missing product or reactant in the boxes below. Be sure to indicate stereochemistry for Diels-Alder reactions (stereochemistry not needed for any other reactions). (20 pts)



2. Draw the products of the following reaction and describe the relationship between the two products. **Be as specific as possible** in your description of their relationship! (6 pts)

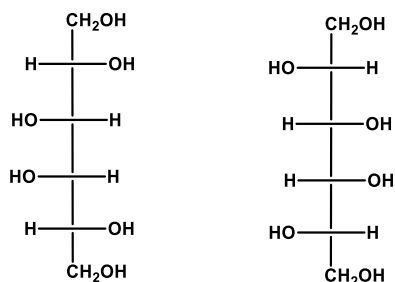


3. Fill in each missing reagent or product in the synthetic scheme shown below. (7 pts)



4. Select the **best** answer for each question below. Put your answers in the boxes provided. (12 pts total)

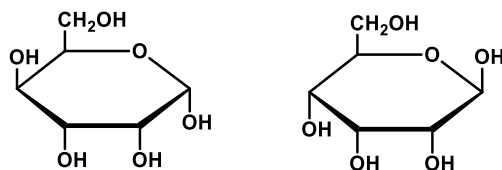
The relationship between the two structures below is best described as:



(answer)

- A) Identical B) Enantiomers C) Anomers D) Diastereomers

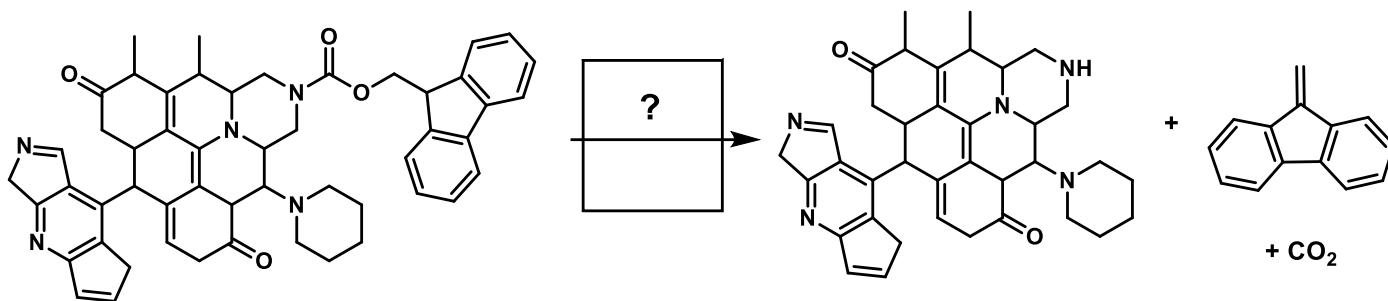
The relationship between the two structures below is best described as:



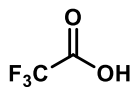
(answer)

- A) Identical B) Enantiomers C) Anomers D) Diastereomers

Which reagent below will achieve the following transformation?



(answer)



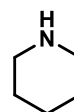
A)



B)

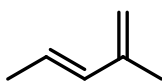


C)

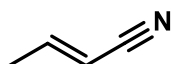


D)

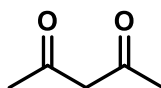
Which of the following could act as Michael acceptor?



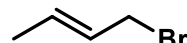
A)



B)



C)



D)

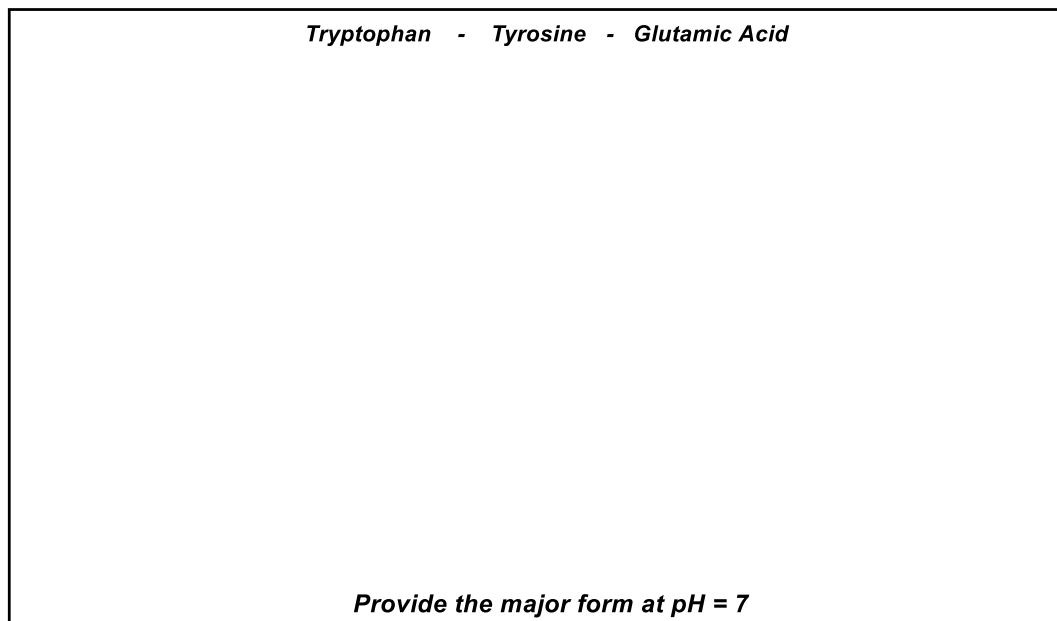
Name: _____

IA																				0															
1 H 1.008		IIA																		2 He 4.003															
3 Li 6.941		4 Be 9.012																				5 B 10.81		6 C 12.01		7 N 14.01		8 O 16.00		9 F 19.00		10 Ne 20.18			
11 Na 22.99		12 Mg 24.31		IIIB		IVB		VB		VIB		VIIB		VIIIB				IB		IIB		13 Al 26.98		14 Si 28.09		15 P 30.97		16 S 32.06		17 Cl 35.45		18 Ar 39.95			
19 K 39.10		20 Ca 40.08		21 Sc 44.96		22 Ti 47.90		23 V 50.94		24 Cr 52.00		25 Mn 54.94		26 Fe 55.85		27 Co 58.93		28 Ni 58.70		29 Cu 63.55		30 Zn 65.38		31 Ga 69.72		32 Ge 72.59		33 As 74.92		34 Se 78.96		35 Br 79.90		36 Kr 83.80	
37 Rb 85.47		38 Sr 87.62		39 Y 88.91		40 Zr 91.22		41 Nb 92.91		42 Mo 95.94		43 Tc (98)		44 Ru 101.1		45 Rh 102.9		46 Pd 106.4		47 Ag 107.9		48 Cd 112.4		49 In 114.8		50 Sn 118.7		51 Sb 121.8		52 Te 127.6		53 I 126.9		54 Xe 131.3	
55 Cs 132.9		56 Ba 137.3		57 * La 138.9		72 Hf 178.5		73 Ta 180.9		74 W 183.9		75 Re 186.2		76 Os 190.2		77 Ir 192.2		78 Pt 195.1		79 Au 197.0		80 Hg 200.6		81 Tl 204.4		82 Pb 207.2		83 Bi 209.0		84 Po (209)		85 At (210)		86 Rn (222)	
87 Fr (223)		88 Ra (226.0)		89 *** Ac (227)		104 Rf		105 Ha		106 Unh		107 Uns		108		109 Uue																			

* 58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
*** 90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (244)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

Amino acid tables are attached as the last two pages of this document. You may tear them off for easier reference.

5. In the box on the left, provide the major form of the following tripeptide of L-amino acids at pH = 7. In the box to the right, show how you would calculate the pI of this peptide. (12 pts)

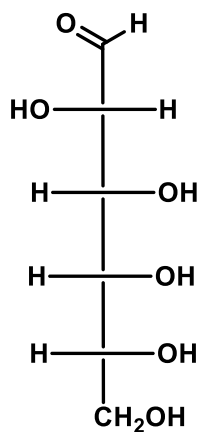


Isoelectric Point

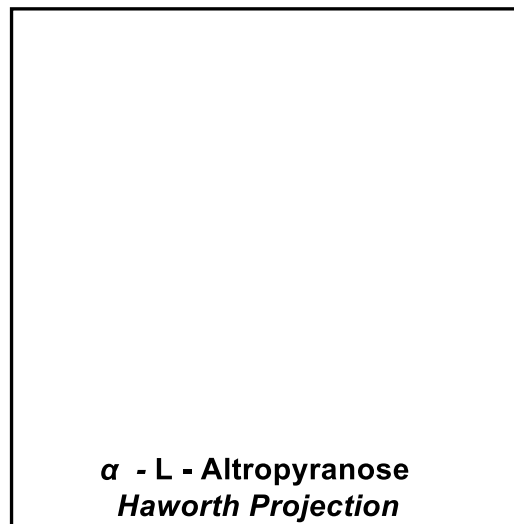
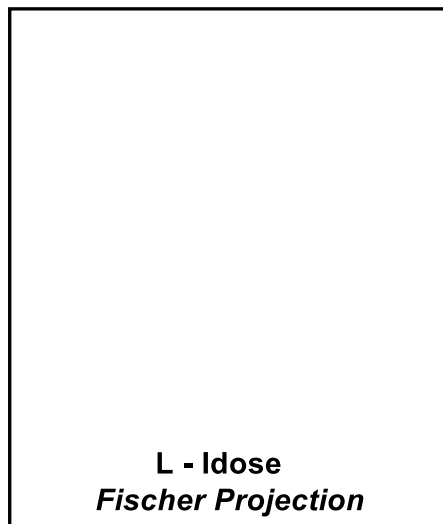


(just show calculation - no final answer needed)

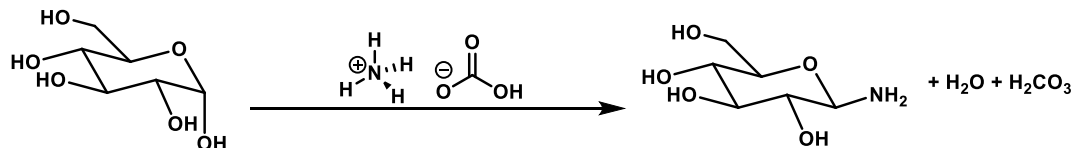
6. The Fischer projection of D-Altrose is shown below. Idose is a C4 epimer of Altrose. Use this information to draw the missing structure in each box below. (8 pts)



D - Altrose

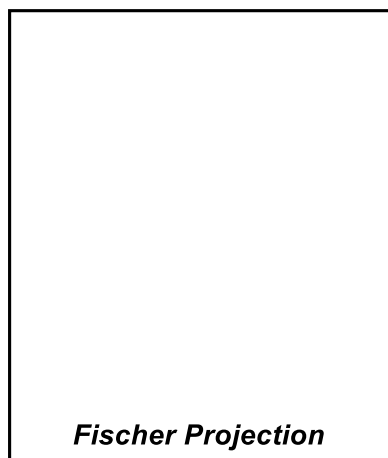
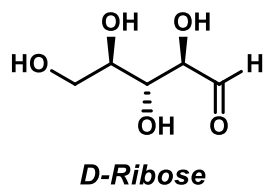


7. In class we learned how to convert glucopyranose into glycosides; glycosylamines can be made in a similar fashion, as shown below. In the first box, provide a mechanism for glycosylamine formation. Then, provide a **BRIEF** explanation for why only the anomeric OH is substituted and not the other OH groups. (You could refer to your mechanism as part of this explanation.) (12 pt)



Explanation

8. The bond-line structure of D-Ribose is shown below. Draw the Fischer projection of D-Ribose. Then circle the term that correctly classifies D-Ribose. (6 pts)



D-Ribose is a(n)....

Aldohexose

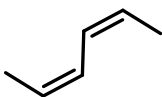
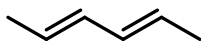
Aldopentose

Ketohexose

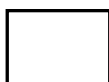
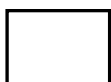
Ketopentose

(circle one)

9. Rank the following dienes below in terms of the rate of their Diels-Alder reaction with $\text{CH}_2=\text{CH}_2$. (5 pts)
(1 = fastest Diels-Alder reaction; 3 = slowest)



Rank:



Bonus (1 pt all or nothing): We discussed each of these terms at some point during this semester. Mark each definition below as true or false. You must get all 3 correct to get the bonus point!

$\text{pK}_a = -\log(\text{K}_a)$ _____

$\text{pH} = -\log[\text{H}^+]$ _____

$\text{pI} = -\log[\text{I}^-]$ _____

10. Provide a complete synthesis of the following tripeptide starting from the individual L-amino acids: Phenylalanine – Leucine – Threonine. You may use abbreviations for reagents and protecting groups, where appropriate, but you must draw the full structure of the tripeptide at the end, and you must show the full structure of each amino acid at least once. (12 pts)

Phenylalanine - Leucine - Threonine

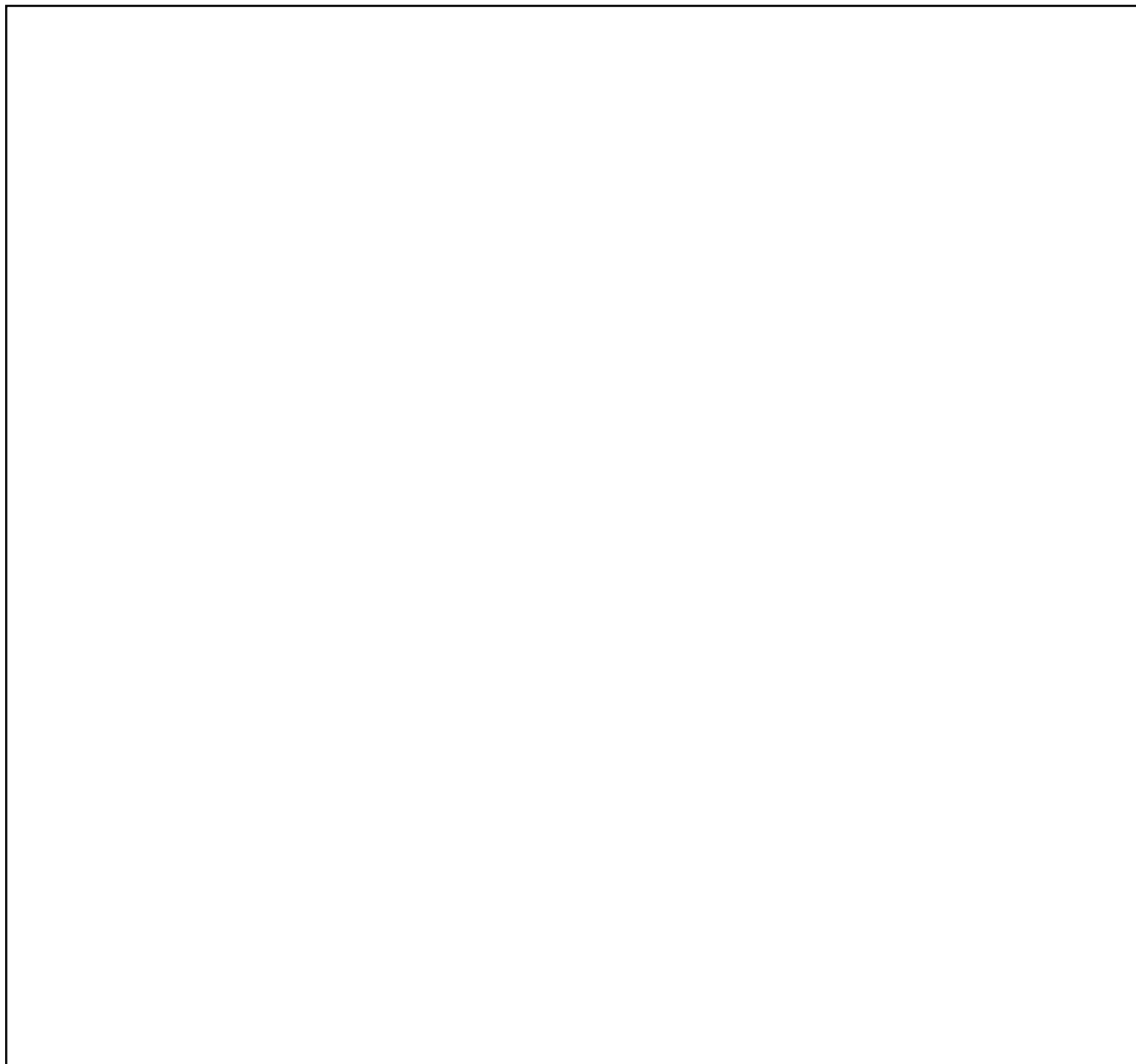


TABLE 25.1 THE STRUCTURES OF THE TWENTY NATURALLY OCCURRING AMINO ACIDS THAT ARE FOUND IN PROTEINS

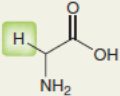
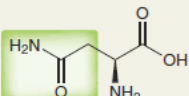
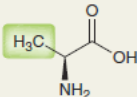
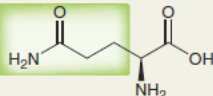
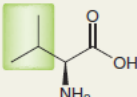
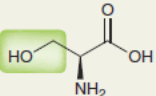
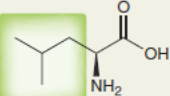
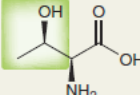
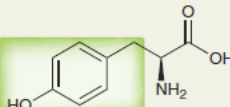
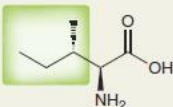
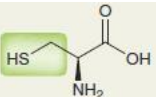
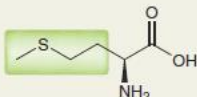
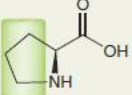
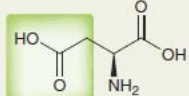
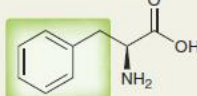
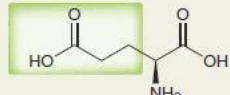
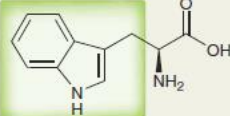
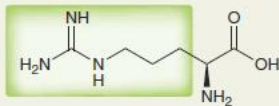
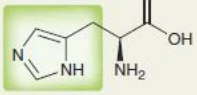
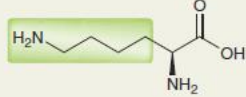
Name	Structure	Abbreviation	Name	Structure	Abbreviation
Amino acids with nonpolar side chains			Amino acids with polar side chains		
Glycine		Gly G	Asparagine		Asn N
Alanine		Ala A	Glutamine		Gln Q
Valine		Val V	Serine		Ser S
Leucine		Leu L	Threonine		Thr T
			Tyrosine		Tyr Y
Isoleucine		Ile I	Cysteine		Cys C
Methionine		Met M	Amino acids with acidic side chains		
Proline		Pro P	Aspartic acid		Asp D
Phenylalanine		Phe F	Glutamic acid		Glu E
Tryptophan		Trp W	Amino acids with basic side chains		
			Arginine		Arg R
			Histidine		His H
			Lysine		Lys K

TABLE 25.2 THE pK_a VALUES FOR TWENTY NATURALLY OCCURRING AMINO ACIDS

AMINO ACID	α -COOH	α -NH ₃ ⁺	SIDE CHAIN
Alanine	2.34	9.69	—
Arginine	2.17	9.04	12.48
Asparagine	2.02	8.80	—
Aspartic acid	1.88	9.60	3.65
Cysteine	1.96	10.28	8.18
Glutamic acid	2.19	9.67	4.25
Glutamine	2.17	9.13	—
Glycine	2.34	9.60	—
Histidine	1.82	9.17	6.00
Isoleucine	2.36	9.60	—
Leucine	2.36	9.60	—
Lysine	2.18	8.95	10.53
Methionine	2.28	9.21	—
Phenylalanine	1.83	9.13	—
Proline	1.99	10.60	—
Serine	2.21	9.15	—
Threonine	2.09	9.10	—
Tryptophan	2.83	9.39	—
Tyrosine	2.20	9.11	10.07
Valine	2.32	9.62	—