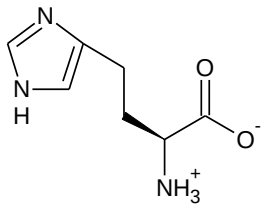
CHEMV12B, Organic Chemistry II

1.) Name **three** structural differences between DNA and RNA. (12 pts, 4 pts ea)

(1) DNA: double helix (2 strands) vs. RNA: single strand
(2) DNA: thymine vs. RNA: uracil
(3) DNA: deoxyribose vs. RNA: D-ribose

2.) For each pair of amino acids, (1) identify each by name, (2) classify each as acidic/polar, basic/polar, aromatic, aliphatic, neutral polar, sulfur, and/or twisty, and (3) list all possible interactions between the two that would hold together its tertiary structure. (80 pts, 20 pts ea)

a.)



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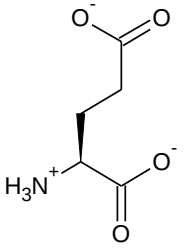
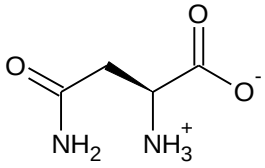


(1) histidine
(2) basic/polar, aromatic

(1) glutamic acid
(2) acidic/polar

(3) salt bridges (acid + base), hydrogen bonding (both polar)

b.)



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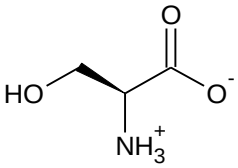
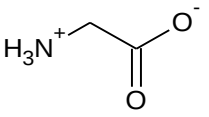


(1) asparagine
(2) neutral polar

(1) serine
(2) neutral polar

(3) hydrogen bonding (both polar), metallic ion coordination (both partially negative)

c.)



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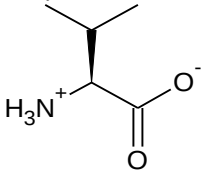
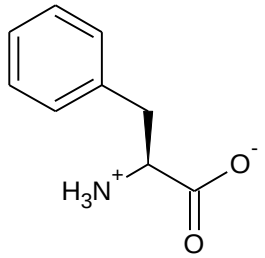


(1) glycine
(2) twisty

(1) valine
(2) aliphatic

(3) hydrophobic interactions (both nonpolar)

d.)



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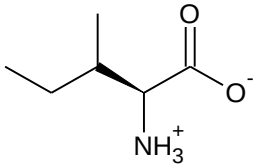


(1) phenylalanine
(2) aromatic

(1) isoleucine
(2) aliphatic

(3) hydrophobic interactions

3.) Consider the following fragment of a nucleic acid. (16 pts)

3'-GCATACGCCGCAACTATT…

a.) Is this DNA or RNA? **Explain.**
DNA – contains thymine

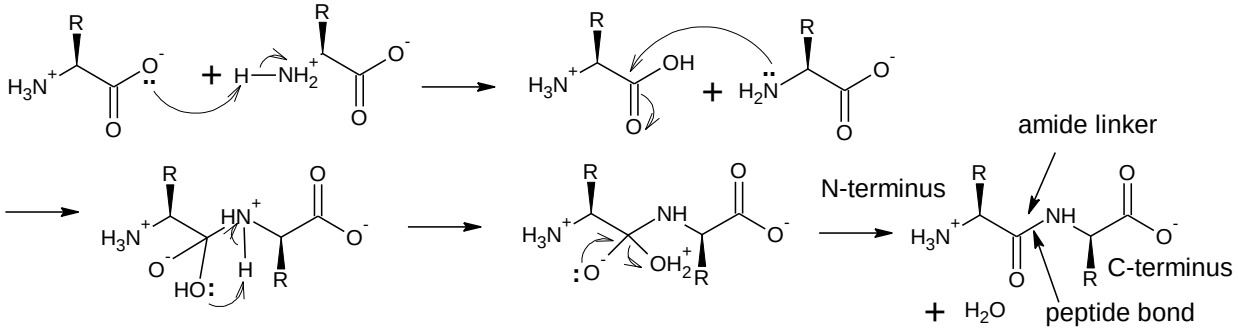
b.) Give the sequence of the *complementary* strand's matching fragment.
5'-CGTATGCGGCGTTGATAA…

c.) Give the sequence of the product after *transcription* of the leading strand's fragment.
5'-CGUAUGCGGCGUUGAUAA

d.) Give the sequence of the product after *translation* of this fragment.
Met-Arg-Arg

4.) Consider a generic dipeptide. (30 pts)

a.) Show the general mechanism for its formation. Show both amino acids in their *zwitterionic* forms. Indicate the side chains on each amino acid with "R". Show all *chirality* (wedges and dashes) and *geometry*.



b.) In the product above, identify the (1) C-terminus, (2) N-terminus, (3) amide linker and (4) peptide bond.

c.) Classify this type of reaction in **two** ways.

(1) condensation (2) dehydration

5.) Identify the type of molecule that forms the following secondary structures. (12 pts, 3 pts ea)

a.) α-helix **proteins**

b.) double helix **DNA**

c.) single strand knots **RNA**

d.) β-sheet **proteins**

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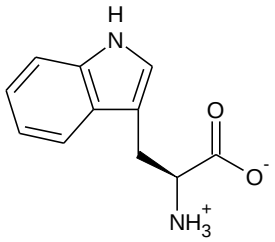
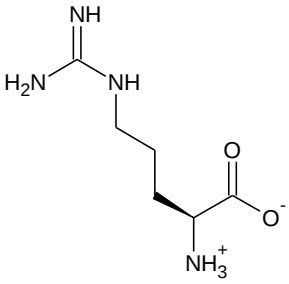
6.) Consider the following amino acids. (25 pts)



(A)



(B)

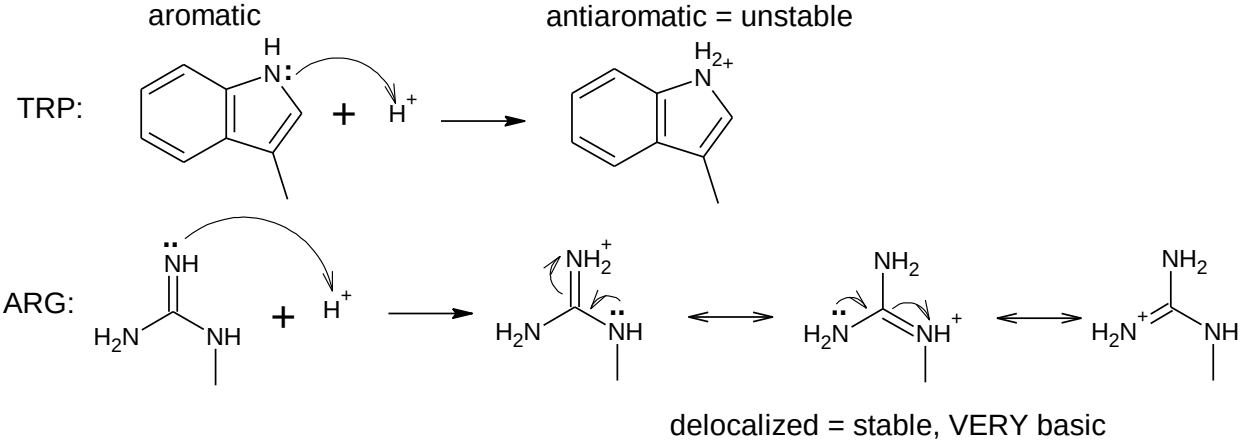
a.) Name (A).

tryptophan

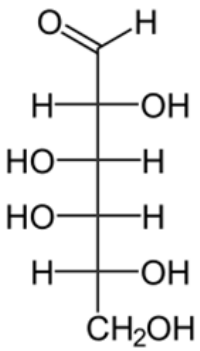
b.) Name (B).

arginine

c.) Which amino acid is overall *more basic*? **Explain**. Your answer should include any relevant resonance structures. You may abbreviate the structures to show only the relevant sections.



7.) Consider the following carbohydrate. (25 pts)



a.) Name this structure. **D-galactose (right)**

b.) Give the common structure name for this carbohydrate.

aldohexose

c.) Is this a *reducing sugar*? **Explain**.
YES – contains CHO group that can be oxidized to COOH

d.) Draw the Haworth projection for this carbohydrate in α–cyclic form. (1) Star the anomeric carbon and (2) circle the hemiacetal functional group.