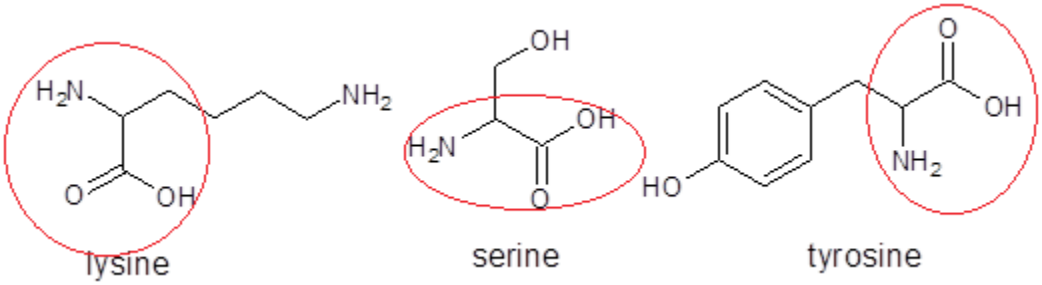
PRACTICE EXAM #4

Chem21, Introduction to Organic and Biochemistry

Instructions: Don't panic. There are three (3) total pages for this exam. For every question, read all given directions and follow them completely. Clearly and logically show all your work and reasoning where applicable. Box all final answers.

1.) Consider the structures of lysine, serine, and tyrosine below. (46 pts)



a.) Circle only the amino acid backbone in each.

b.) Classify each as (1) acidic-polar, (2) basic-polar, (3) neutral-polar, or (4) nonpolar.

Lysine ___**(2) basic-polar**___

Serine ___**(3) neutral-polar**___

Tyrosine ___**(3) neutral-polar**___

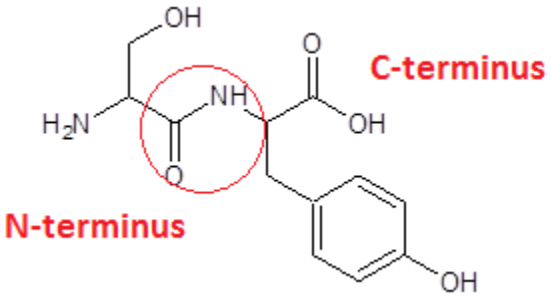
c.) For each pair of amino acids, identify which side chain interaction will predominate from (1) hydrogen bonding, (2) covalent bonds, (3) salt bridges, or (4) hydrophobic interactions.

Lysine + Serine ___**(1) hydrogen bonding**___

Tyrosine + Lysine ___**(3) salt bridges**___

Serine + Tyrosine ___**(1) hydrogen bonding**___

d.) Draw the full structure of the **dipeptide** with the sequence Ser-Tyr.



e.) Clearly indicate the **C-terminus** and the **N-terminus** in the structure in (d).

f.) How many **amide** groups are in (d)? Circle them. ___**one**___

PAGE 1: _____

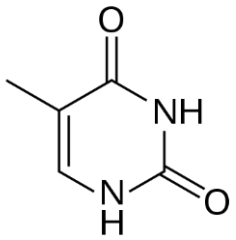
2.) List at least two structural differences between DNA and RNA. (10 pts, 5 pts ea)

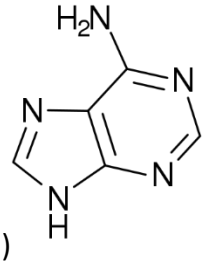
DNA contains **thymine**; RNA contains **uracil**

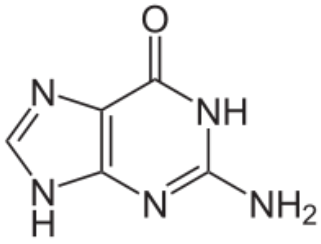
DNA forms a **double**-stranded helix; RNA is a **single**-strand.

DNA contains **deoxyribose**; RNA contains **D-ribose**

3.) Identify the following nucleic acids as (1) adenine, (2) guanine, (3) cytosine, (4) thymine, or (5) uracil. (15 pts, 5 pts ea)

(a) 

(b) 

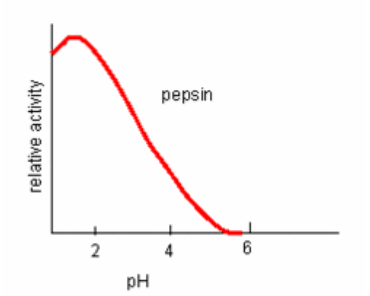
(c) 

a.) **(4) thymine**

b.) **(1) adenine**

c.) **(2) guanine**

4.) Consider the enzyme pepsin, whose activity was graphed against pH. (15 pts)



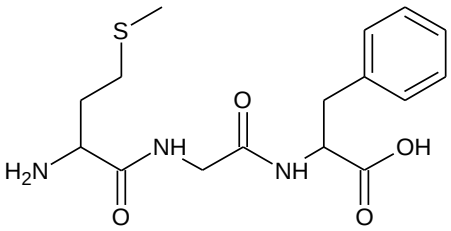
a.) Estimate the optimal pH. **1.5-2**

b.) Would pepsin be active at pH > 6? **no**

c.) Would increasing [substrate] *always* increase the activity of pepsin? Why or why not?

It would **increase** until the **point of saturation** is reached, at which increasing [substrate] will have no affect.

5.) Consider the following peptide with the primary structure Met-Gly-Phe. (23 pts)



a.) How many peptide bonds are present? **2**

b.) How many amino acids will be formed after hydrolysis? **3**

c.) Give the full names of all three amino acids.

Met: **methionine**

Gly: **glycine**

Phe: **phenylalanine**

PAGE 2: _____

6.) Consider the following single DNA fragment. (20 pts)

3'-T A C G A C C T T A A G A T C G C T …

a.) Write the sequence for the *complimentary* DNA strand.
5'-A T G C T G G A A T T C T A G C G A …

b.) Write the sequence for the product via *replication* of the leading strand.
5'-A T G C T G G A A T T C T A G C G A …

c.) Write the sequence for the product via *transcription* of the leading strand.
5'-A U G C U G G A A U U C U A G C G A …

d.) Write the sequence for the product via *translation* of the mRNA.
Met-Ser-Arg-Phe

7.) Give the two most common *secondary* structures of proteins. (10 pts, 5 pts ea)

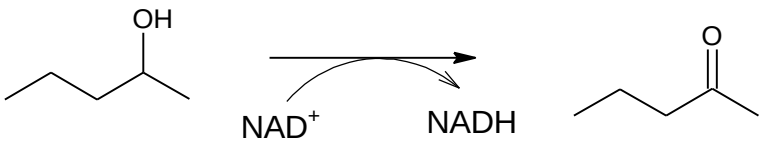
α-helix and **β-sheets**

8.) Define *essential* and *nonessential*, in terms of amino acids. (10 pts, 5 pts ea)

Essential: amino acids that cannot be synthesized by the body and must be consumed in one's diet

Nonessential: amino acids that can be synthesized by the body

9.) Consider the following reaction. (16 pts)



a.) Is 2-pentanol being *oxidized* or *reduced*? **oxidized**

b.) Explain your answer in (a).

The secondary alcohol is **losing bonds to H** and **gaining bonds to oxygen**.

c.) Is NAD+ being *oxidized* or *reduced*? **reduced**

d.) Explain your answer in (c).

NAD+ is **gaining electrons** and **bonds to H**.

PAGE 3: _____