June 26, 2002
Exam 1
NESA – Summer 2002

Name _____

All questions are worth two points unless specified in parentheses. This exam is closed book, closed notes, and no collaboration is permitted.

Multiple choice

1. Each of the following is a polar amino acid except
   a. serine b. valine c. threonine
   d. glutamine e. cysteine

2. Each of the following amino acids have polar, but uncharged side chains except:
   a. methionine b. threonine c. serine
   d. cysteine e. glutamine

3. At pH = 1, arginine, glutamic acid, and alanine will have total charges of:
   a. +3, –2, and –1, respectively b. +3, –2, and 0, respectively
   c. +2, +1, and 0, respectively d. +2, +1, and +1, respectively
   e. 0, 0, and 0, respectively

4. The only amino acid that is not chiral:
   a. alanine b. lysine
   c. glycine d. proline

5. The primary structure of a polypeptide is another name for the _____ of the molecule.
   a. 3-dimensional shape b. ß-sheet quality
   c. amino acid sequence d. interaction between R-groups

6. When writing amino acid sequences, the left-most amino acid is the _____, and the right most is the _____.
   a. C-terminus / N-terminus b. N-terminus / C-terminus

7. Besides hydrogen bonds, another strong, non-covalent interaction between R-groups in tertiary structures is:
   a. disulfide bridge. b. peptide linkage.
   c. salt bridge (charged interaction) d. all of the above

8. Which of the following are responsible for the three dimensional structure of proteins?
   a. Ionic Bonds b. Hydrogen Bonds
   c. Hydrophobic interactions d. All of the above

9. Enzymes work by:
   a. lowering the activation energy of the reaction.
   b. providing an alternate path for the reaction.
   c. speeding up the forward and reverse reactions.
   d. All of the above

10. The active site of an enzyme is often said to be highly specific. In terms of structure and/or function, this means:
   a. it only works with certain allosteric effectors.
   b. it only catalyzes the forward reaction.
   c. it only fits certain classes of substrates.
   d. it must have a quaternary structure.

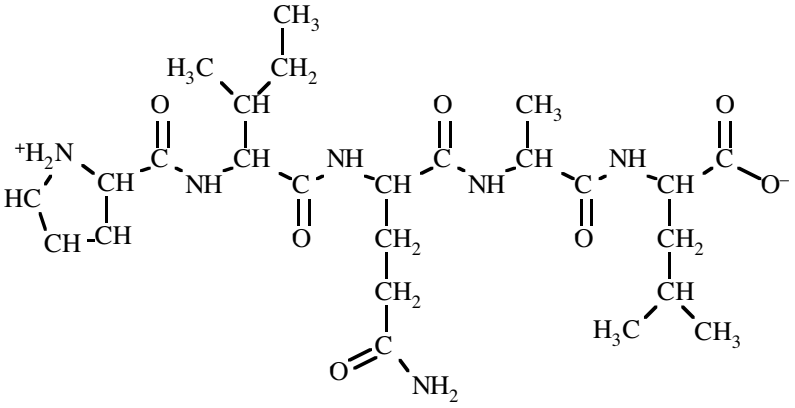
11. In the induced fit model, the enzyme:
   a. changes its shape to fit the substrates.
   b. has a second active site to fit the co-factor.
   c. alters the shape of the active site to bring substrates closer together.
   d. has an active site that exactly fits the substrates.

12. Which of the following amino acids do you LEAST expect to find in the interior of a globular protein?
   a. Val b. Lys c. Ile d. Leu

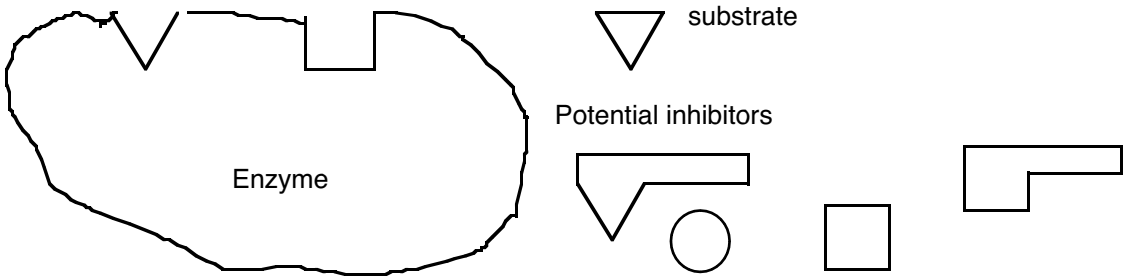
13. A protein with a quaternary structure is made up at least two subunits. If the two subunits are held together by the interaction between a lysine on one subunit and the glutamate of the other, the bond between them is said to be a:
   a. salt bridge (charged interactions). b. peptide bond.
   c. disulfide bond d. hydrophobic interaction

Completion and short answer

14. What is the sequence of the following peptide? Use three-letter codes. (3 pts)



15. Consider the follow enzyme, substrate, and potential inhibitors (each part 2 pts):



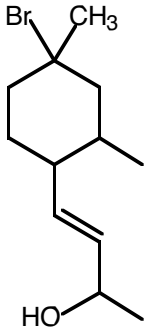
a. Circle the active site (2 pts)

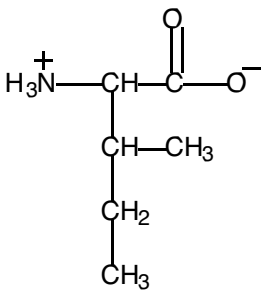
b. Show the interaction between the enzyme and a competitive inhibitor.

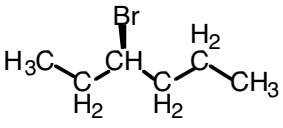
c. Show the interaction between the enzyme and a potential non-competitive inhibitor.

16. Draw the peptide Ala–Asp–Lys–Phe as it would appear at in water pH = 7.4 (5 pts).

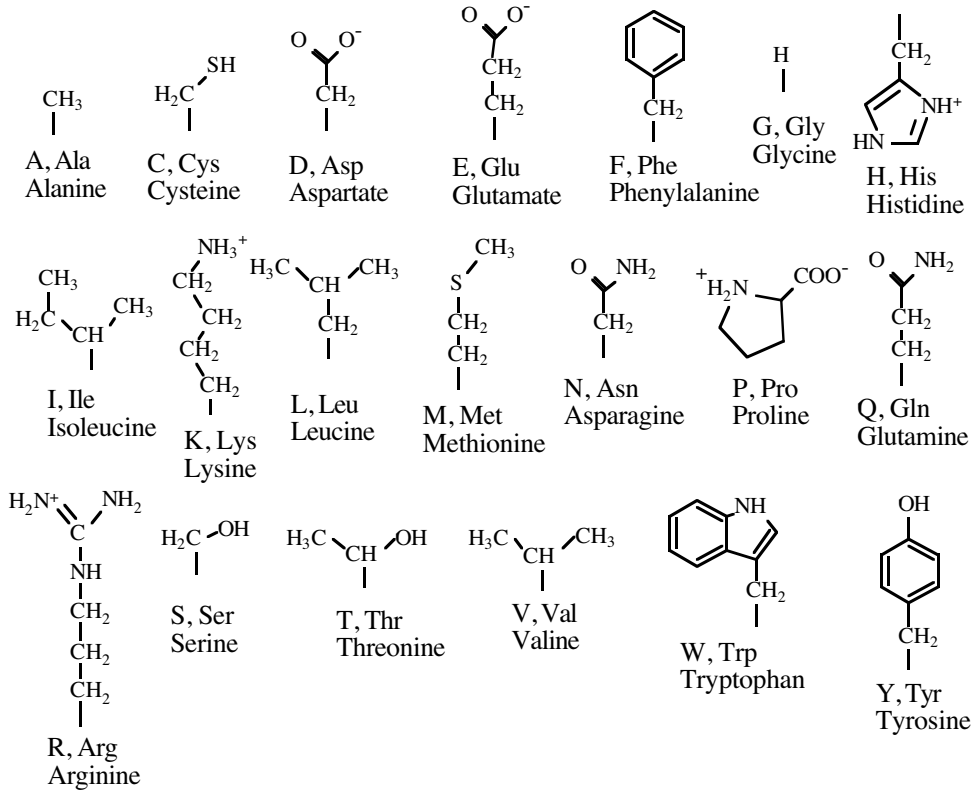
17. Identify the chiral centers in the following compounds. (2 pts each).







Useful Information:



Intrinsic pK_a Values for Ionizable Groups Found in Proteins

Group	Observed pK_a
α-Amino	6.8 – 8.0
α-Carboxyl	3.5 – 4.3
β-Carboxyl (Asp)	3.9 – 4.0
γ-Carboxyl (Glu)	4.3 – 4.5
δ-Guanido (Arg)	12.0
ε-Amino (Lys)	10.4 – 11.1
Imadazol (His)	6.0 – 7.0
Thiol (Cys)	9.0 – 9.5
Phenolic hydroxyl (Tyr)	10.0 – 10.3

pI values for amino acids

AA	pI	AA	pI	AA	pI
Ala	6.0	Gln	5.7	Pro	6.4
Asn	5.4	Glu	3.2	Ser	5.7
Arg	10.8	Ile	6.0	Thr	5.6
Asp	3.0	Leu	6.0	Trp	5.9
Cys	5.0	Lys	9.7	Tyr	5.7
His	7.6	Met	5.7	Val	6.0
Gly	6.0	Phe	5.5		