Metabolic Biochemistry 3350
Dr. Melissa Kelley
Exam I
September 23, 2005

Multiple Choice: Choose the one best answer to each question (2 points each)

_____1. Which one of the following statements **is not correct**?

A. The attraction between a positively charged arginine chain and a negatively charged aspartic acid is known as a charge-charge interaction.
B. The dipole moment of water helps make it a good solvent for polar molecules.
C. The hydrogen bond is much stronger than a covalent bond.
D. Two non-covalent interactions that cause aliphatic molecules to pack together compactly in water instead of being individually solvated are the hydrophobic effect and van der Waals interactions.

_____2. Which of the following non-covalent forces would occur when two atoms that **are not** covalently bonded to each other come so close together that their electron clouds overlap?

A. hydrogen bonding
B. van der Waals repulsion
C. van der Waals attraction
D. ionic interactions

_____3. Which of the following **is not true** of biomolecules?

A. They are formed from water, carbon dioxide, and inorganic nitrogen.
B. They have a three-dimensional shape that is important for recognition.
C. The forces that hold biomolecules together are largely covalent forces.
D. They are capable of aggregating and forming supramolecular complexes.

_____4. Which of the following amino acids would be involved in a salt bridge of a protein?

A. cysteine and lysine
B. lysine and glutamic acid
C. glycine and histidine
D. alanine and glutamic acid

Fill in the blank

5. (12 points) Most proteins are composed of twenty different amino acids connected by _____bonds between the amino group of one amino acid and the _____ group of another amino acid. The sequence of amino acids in a protein, which is also known as the _____ structure of a protein. Two main types of secondary structure are the _____ and the _____. These secondary structures are held together chiefly by _____bonds. _____ bonds are formed between two cysteines in a protein. Some proteins contain more than one polypeptide chain. In such a protein _____ structure refers to the way in which these chains are packed together.

6. (6 points) Below on the right are listed the 3-letter abbreviations of several amino acids. In each blank, match the amino acid with the description that fits on the left.

_____ Negatively charged at neutral pH.	A. Pro
_____Positively charged at neutral pH.	B. Gln
_____Side chain is aromatic and hydrophobic	C. Ile
_____Side chain is aliphatic and highly hydrophobic	D. Lys
_____Uncharged but quite hydrophilic	E. Glu
_____Cyclic, bonded to an amino group, making this amino acid less flexible than others	F. Phe

Short Answer

7. (3 points each) Draw the structures of the following amino acids at pH 7.0.

a. Glutamate

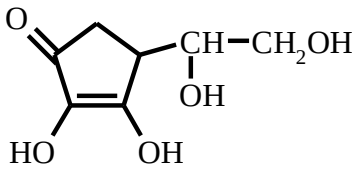
b. Asparagine

c. Tryptophan

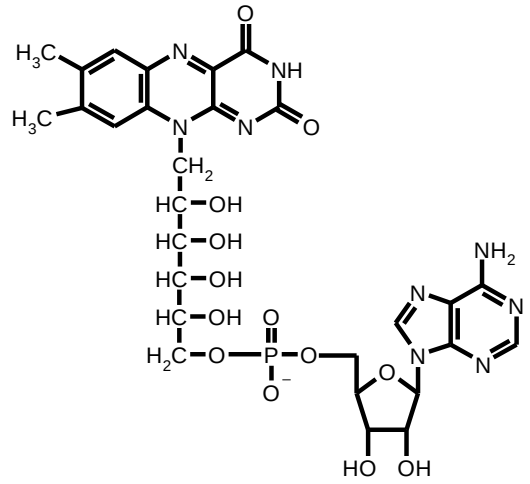
c. Threonine

d. Cysteine

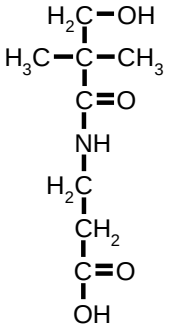
8. (3 points) Identify the vitamin and provide one sentence that describes the function of this vitamin.



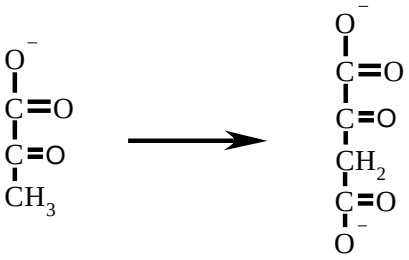
9. (3 points) Identify this compound and tell me from which vitamin it is derived. Circle the reactive sites on this compound.



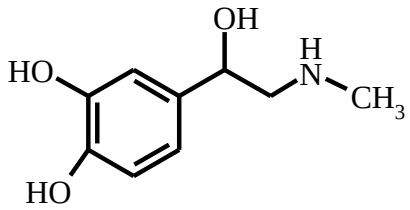
10. (3 points) Identify the vitamin and provide one sentence that describes the function of this vitamin.



11. (3 points) Shown below is a chemical reaction. Identify the vitamin that would be involved in this reaction.

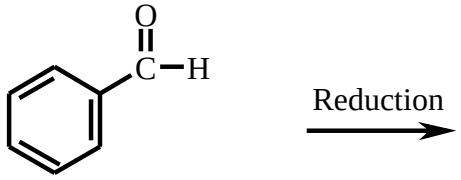


12. (10 points) Shown below is the structure of epinephrine that is responsible for the flight or fight response. Draw all missing lone pairs of electrons on atoms that contain them. Using your knowledge of hydrogen bonding, show how water would hydrogen bond to epinephrine (show two water molecules, one acting as an acceptor and the other acting as a donor).

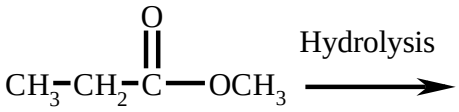


Shown below are organic reactions. Assume that all of the reactions are enzymatically driven. In the box provided give the major product for the reaction (4 points each)

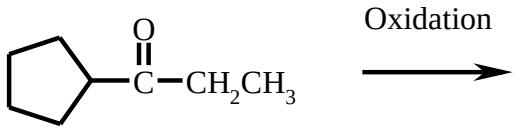
13.



14.

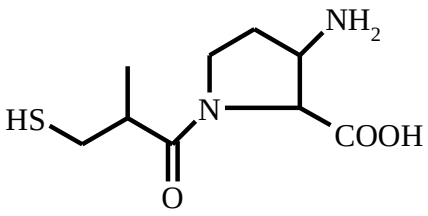


15.



Short essay. For the questions below answers should be concise (1-3 sentences) and can include pictures and/or structures if it helps clarify your discussion of the question.

16. (15 points) Shown below is the structure of Captopril which is an anti-hypertensive drug.



a. You have discovered that an intestinal protease enzymatically cleaves this drug. What type of products would you expect.

b. You have discovered a blood binding protein for captopril. What type of amino acid residues would you expect in the binding pocket of your protein that would bind captopril? Briefly explain your answer. Structures are not required

17. (10 points) A patient is observed to be hyperventilating. Based on your knowledge of hyperventilation, predict what would happen to your patient's hemoglobin.