

Name _____
Write your name on the back of the exam

Physiological Chemistry II
Exam III
Dr. Melissa Kelley
March 16, 2004

This examination consists of forty-three questions, each having 2 points. The remaining questions have point values listed by the question. Provide the one best answer for each, following the instructions given in each section of the exam. You have 75 minutes to complete the exam.

Multiple Choice. Select the one best answer to each question. Questions 1-16.

- _____ 1. Enzymes which catalyze the rearrangement of atoms in a substrate are known as:
A. Transferases
B. Ligases
C. Lyases
D. Isomerases
- _____ 2. Which statement is **not true** about phospholipids?
A. They contain glycerol as the backbone.
B. They contain two fatty acids.
C. They contain a phosphate ester.
D. They contain spingosine as the backbone.
- _____ 3. Which of the following statements about proteins is **not correct**?
A. Non-covalent interactions have an effect in holding proteins in their correct shape.
B. Detergents stabilize proteins by stabilizing the hydrophobic effect.
C. Proteins are held in their tertiary structure through non-covalent interactions of amino acid side chains.
D. Hydrogen bonding in the peptide backbone stabilizes secondary structure in proteins.
- _____ 4. Which of the following would be solid at room temperature?
A. Palmitic acid (16:0)
B. Oleic acid (18:1)
C. Linolenic acid (18:3)
D. Arachidonic acid (20:4)
- _____ 5. Alcohol dehydrogenase is an enzyme that catalyzes the oxidation of retinol to retinal. The V_{max} for alcohol dehydrogenase is 500 units/min and the K_m is 4 mM. Normal substrate concentrations of retinol are maintained at 1 mM. What is the rate of this reaction if normal retinol concentrations are maintained?
A. 50 units/min
B. 75 units/min
C. 100 units/min
D. 125 units/min

- _____ 6. Which of the following statements is **not true**?
- A. Triacylglycerides are fatty acids esterified to an alcohol.
 - B. Sphingolipids are found in gangliosides.
 - C. Cerobrosides have a glycerol backbone.
 - D. Cholesterol is a steroidal alcohol.
- _____ 7. Which of the following amino acids would be located on the exterior of a protein?
- A. Tryptophan
 - B. Methionine
 - C. Serine
 - D. Phenyalanine
- _____ 8. Which of the following statements about enzymes is **not correct**?
- A. A competitive inhibitor of an enzyme binds at the active site.
 - B. Allosteric enzymes follow Michaelis-Menton kinetics and have hyperbolic kinetic plots.
 - C. A noncompetitive inhibitor lowers the V_{max} of an enzyme.
 - D. Enzymes are specific for substrate molecules.
- _____ 9. Which of the following statements is **not true**?
- A. Cholesterol is a precursor to progesterone.
 - B. Arachidonic acid is produced from linolenic and linoleic acids.
 - C. Hydrogenation of TAG will yield unsaturated fatty acids.
 - D. Cell membranes are highly ordered and stable.
- _____ 10. Hexokinase, which is an enzyme that catalyzes the first step in carbohydrate metabolism, consists of a single subunit. Which of the following levels of protein structure best describes myoglobin?
- A. Primary structure
 - B. Secondary structure
 - C. Tertiary structure
 - D. Quaternary structure
- _____ 11. Which of the following statements is **not true**?
- A. Phospholipids form a lipid bilayer.
 - B. Cell membranes have integral proteins that are partially embedded in the membrane.
 - C. Cholesterol increase membrane fluidity.
 - D. Glycoproteins and glycolipids are found on the outside of the cell membrane.
- _____ 12. Which of the following amino acids would be involved in a salt bridge of a protein?
- A. Glycine and alanine
 - B. Glutamate and lysine
 - C. Threonine and serine
 - D. Histidine and lysine
- _____ 13. Which of the following statements about enzymes acting as catalysts are **not correct**?
- A. Enzymes increase the concentration of substrates.
 - B. Enzymes decrease the energy barrier for the reaction.
 - C. Enzymes bring reactants together.
 - D. Enzymes are reused and regenerated.

_____14. Which of the following **are not** found in animal cell membranes?

- A. TAG
- B. Cholesterol
- C. Phospholipids
- D. Cerobrosides

_____15. Some enzymes require organic and/or inorganic molecules to be functional. Which of the terms is used to describe both the protein portion and the organic/inorganic portion of this complex molecule?

- A. Holoenzyme
- B. Coenzyme
- C. Zymogen
- D. Apoenzyme

_____16. The following forces hold proteins in their three dimensional shape. Which of the following forces is a covalent interaction?

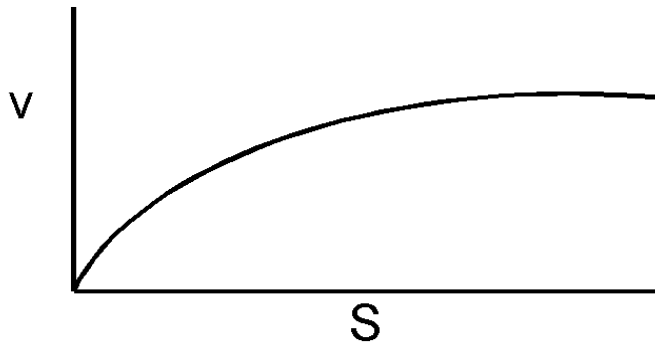
- A. Hydrogen bonding
- B. Formation of salt bridges
- C. Hydrophobic effects
- D. Disulfide bridges

Short answer, fill in the blank or chart (giving one or two word responses). If multiple answers are correct, any one correct answer is acceptable. Questions 17-30.

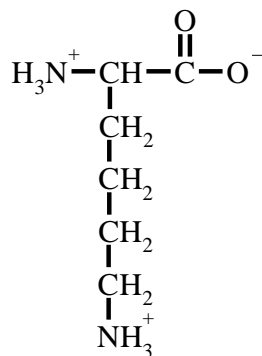
_____17. These enzymes commonly do not demonstrate hyperbolic kinetics with respect to increasing substrate concentrations. Furthermore, these types of enzymes are commonly observed at key regulatory branch points in metabolism. (Fill in the blank)

_____18. Name an amino acid that has an amide containing side chain.

19. In the chart below, the change in reaction rate (v) versus increasing substrate concentration for an uninhibited enzyme is shown. Draw the curve expected if a competitive inhibitor is added to the reaction mixture.



20. In the structure below circle a chiral carbon.



_____ 21. This vitamin is used as a one carbon carrier.

_____ 22. Enzymes, which are synthesized as inactive molecules and later become activated by proteolytic cleavage, are known as (fill in the blank).

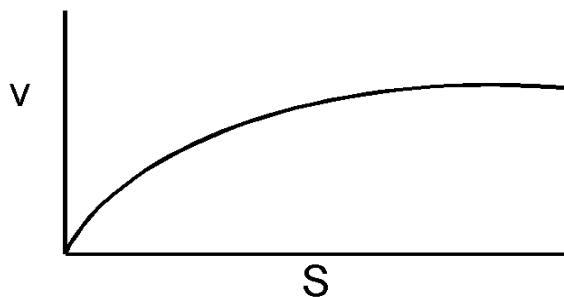
_____ 23. Name a basic amino acid.

_____ 24. This vitamin is used to hydroxylate proline residues in collagen.

_____ 25. This vitamin is used as a carrier of amino acids.

_____ 26. Name an essential amino acid.

27. In the chart below, the change in reaction rate (v) versus increasing substrate concentration for an uninhibited enzyme is shown. Draw the curve expected if a non-competitive inhibitor is added to the reaction mixture.

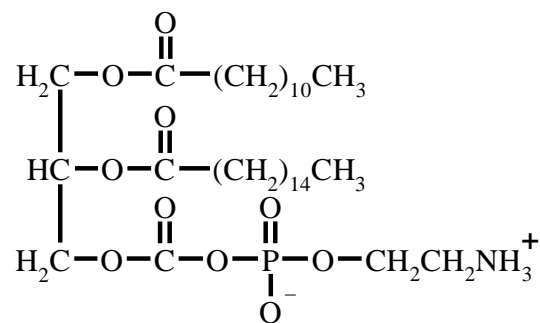


_____ 28. This vitamin serves a precursor to NAD and NADH.

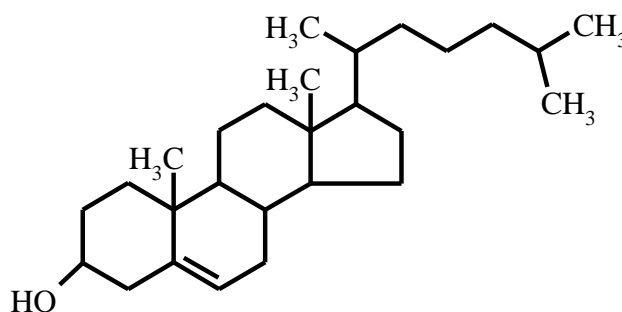
_____ 29. This vitamin participates in isomerase reactions.

_____ 30. This vitamin acts as an electron sink in decarboxylation reactions.

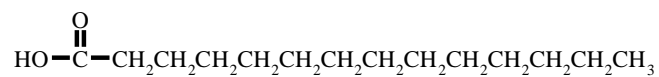
Identify the following lipid compounds. Questions 31-36.



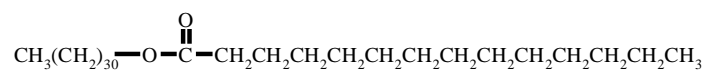
31. _____



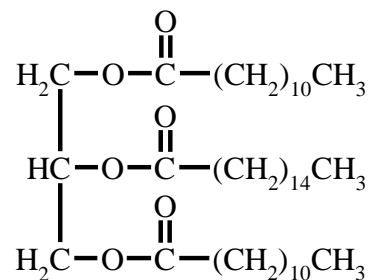
32. _____



33. _____



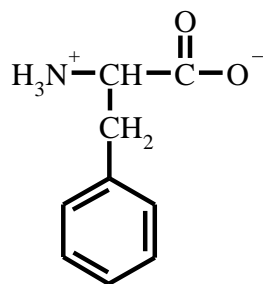
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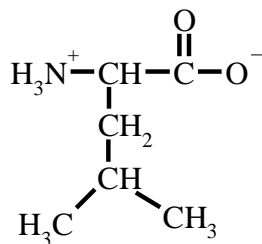
35. _____

36. In the structures shown above which of the following would be found in animal cell membranes? Write their name in the space provided.

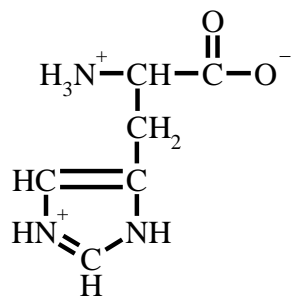
Identify the following compounds by names and write their three-letter code. Questions 37-43.



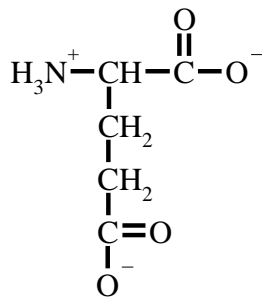
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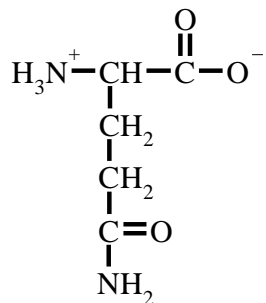
38. _____



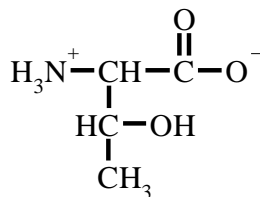
39. _____



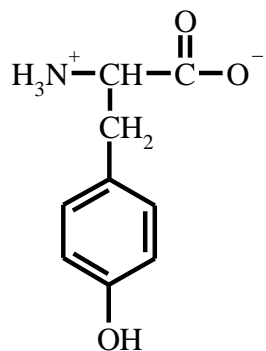
40. _____



41. _____



42. _____



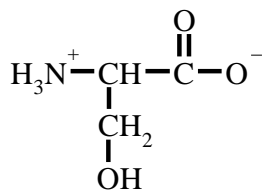
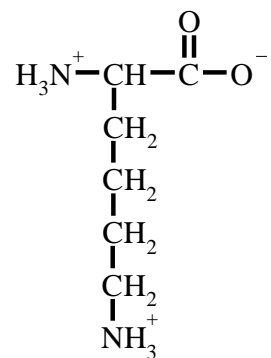
43. _____

Short essay. Questions 44-47.

44. (4 points) Briefly explain why cofactors are required for some enzymes to catalyze reactions.

45. (4 points) A new fat soluble vitamin has been synthesized that promises to decrease sleepiness and increase attentiveness in Physiological II students during Tuesday morning classes. For the vitamin to work effectively it needs to be taken at high concentrations. The marketing of this new vitamin guarantees no adverse effects due to consumption of this vitamin. Do you believe this companies advertisement. Briefly explain your biochemical reasoning.

46. (4 points) Shown below are lysine and serine. Draw the dipeptide that would form if serine is the N-terminal amino acid and lysine is the C-terminal amino acid. Place a square around the atoms involved in the peptide bond.



47. (2 points) Why does the peptide bond have "double-bond like character"?