CHEM 160A Final Exam
December 17, 2004

Name _____
(1 point)

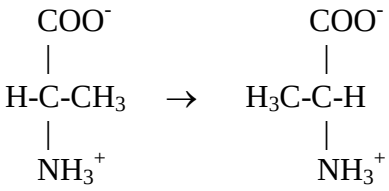
1. (5 points) What factors influence an enzyme's substrate specificity?

2. (4 points) Why are cofactors required for some enzymatic reactions?

3. (5 points) Explain how nucleophiles act as covalent catalysts.

For questions 4 through 7, choose from the list below to tell me which type of enzyme catalyzes the reaction. (3 points each)

a. oxidoreductase
b. transferase
c. hydrolase
d. lyase
e. isomerase
f. ligase

4. 

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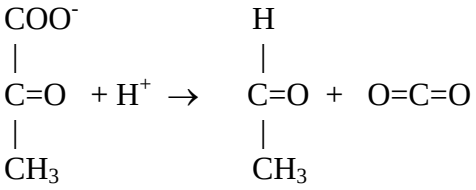
5. 

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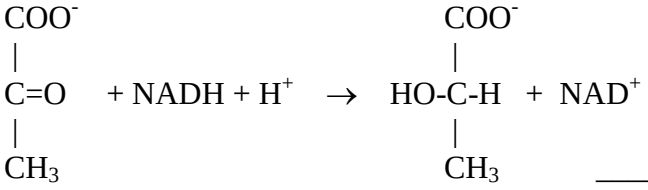
6. 

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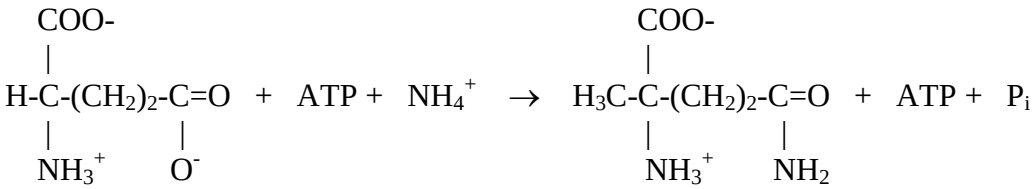
7. 

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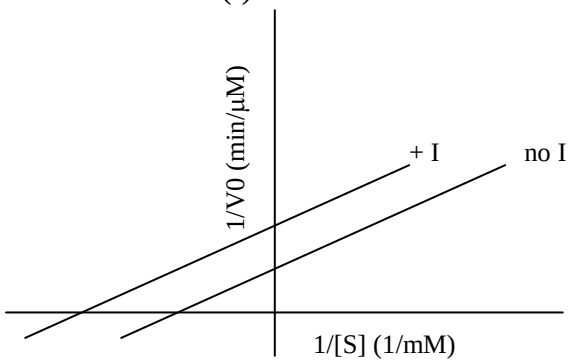
8. (5 points) Draw a transition state diagram of a nonenzymatic reaction and the corresponding enzyme-catalyzed reaction in which S binds loosely to the enzyme.

9. (5 points) Draw a transition state diagram of a nonenzymatic reaction and the corresponding enzyme-catalyzed reaction in which S binds tighty to the enzyme.

10. (5 points) Which of the scenarios you diagramed for questions 8 and 9 makes for a better enzyme? Explain your answer.

11. (9 points) Define and explain the differences between instantaneous velocity, initial velocity, and maximal velocity.

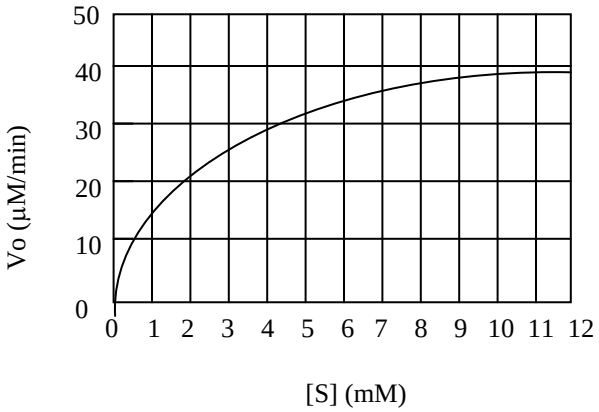
12. (10 points) The Lineweaver-Burk Graph below depicts an enzyme in the absence and presence of its inhibitor (I).



Draw a model (reaction scheme) that shows how this inhibitor interacts with the enzyme (E) and substrate (S).

13. (5 points) What does k_{cat}/K_M reveal about an enzyme?

14. For questions a through c, refer to the Michaelis-Menten Plot below. The concentration of enzyme in this experiment was held constant at 0.2 nM.



a) (2 points) Estimate the V_{max} of this enzyme with this substrate.

V_{max} = _____

b) (5 points) Estimate the K_m of this enzyme with this substrate.

K_m = _____

c) (5 points) What is the approximate k_{cat} of this enzyme with this substrate?

k_{cat} = _____

15. (10 points) Trace the route followed by an integral cell-membrane protein, starting from its synthesis on a ribosome.

16. (5 points) How does the synthesis of a cytosolic protein differ from what you drew for question 15?

17. (8 points) How does the membrane skeleton influence membrane protein distribution?

You are now finished with the last chapter exam. Now starts the cumulative part of the final.

18. (10 points) Describe the similarities and differences between ion exchange column chromatography and gel filtration column chromatography.

19. (1 point) Which amino acid residue allows the least structural flexibility in a protein?

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20. (5 points) A mutation that replaces glutamate with glutamine in an enzyme drastically reduces the activity of that enzyme. It is known that this residue is NOT located at the active site. Speculate as to why this mutation affects enzyme activity.

21. (10 points) Describe the structural and functional <u>similarities</u> and <u>differences</u> between cellulose and amylopectin.

22. (4 points) How does life persist despite the second law of thermodynamics?

23. Use this table to answer questions (a) and (b).

Amino Acid	pK_{NH3+}	pK_{COOH}	pK_R
Aspartic Acid	9.90	1.99	3.90
Glutamic Acid	9.47	2.10	4.09
Serine	9.21	2.19	--

a. (10 points) Draw the tripeptide Asp-Glu-Ser at pH 7, showing each amino acid in the L-configuration.

b. (5 points) Calculate the isoelectric point for Asp-Glu-Ser. **Show your work for credit!**

24. (6 points) Which of the following amino acid residues could help bind a carbohydrate in the active site of an enzyme? (Circle all that apply.)

    a. Lysine
    b. Aspartic acid
    c. Glutamine
    d. Phenylalanine
    e. Isoleucine
    f. Histidine

25. (6 points) Which of the following amino acid residues could act as an acid to catalyze a reaction in the active site of an enzyme? (Circle all that apply.)

    a. Lysine
    b. Aspartic acid
    c. Glutamine
    d. Phenylalanine
    e. Isoleucine
    f. Histidine

26. (6 points) Which of the following amino acid residues could act as a base to catalyze a reaction in the active site of an enzyme? (Circle all that apply.)

    a. Lysine
    b. Aspartic acid
    c. Glutamine
    d. Phenylalanine
    e. Isoleucine
    f. Histidine

27. (6 points) Which of the following amino acid residues could drive formation of a molten globule during protein folding? (Circle all that apply.)

    a. Lysine
    b. Aspartic acid
    c. Glutamine
    d. Phenylalanine
    e. Isoleucine
    f. Histidine

28. (4 points) Draw linolenic acid ($18.3\Delta^{9,12,15}$).

29. (6 points) Give two reasons why triacylglycerols are better for long-term storage of energy than glycogen is.

30. (3 points) Why is glycogen better as a quick source of energy than triacylglycerols are?

31. (5 points) Why is fat a solid at room temperature, while vegetable oil is a liquid at room temperature?

32. (2 points) Why wouldn't triacylglycerols make good membrane lipids?

33. (4 points) Salts of fatty acids, in aqueous solutions, form
    a. Triacylglycerols
    b. Diacylglycerols
    c. Micelles
    d. Lipid bilayers

34. (7 points) Describe the structural and functional similarities and differences between eicosanoids and steroid hormones.