

Chemistry 785
EXAM II
November 12, 1997
Answer Sheet

NAME _____

1. (A) (B) (C) (D)

2. (A) (B) (C) (D)

3. (A) (B) (C) (D)

4. (A) (B) (C) (D)

5. (A) (B) (C) (D)

6. (A) (B) (C) (D)

7. (A) (B) (C) (D)

8. (A) (B) (C) (D)

9. (A) (B) (C) (D)

10. (A) (B) (C) (D)

11. (A) (B) (C) (D)

12. (A) (B) (C) (D)

13. (A) (B) (C) (D)

14. (A) (B) (C) (D)

15. (A) (B) (C) (D)

16. (A) (B) (C) (D)

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INSTRUCTIONS

- *The questions for Part I are to be answered on the cover sheet. Your grade for this section will be determined only from the cover/answer sheet.*

- *Answers for Part II should be answered directly in the space given. Partial credit will be given on this part of the exam so remember to **SHOW ALL WORK**.*

- *PRINT your name on EACH of the exam pages in the designated space.*

PART I (40 points)

-For each of the following questions, circle the one answer that best fits the description. More than one answer per question will receive no points. Blacken the letter of the answer on the cover sheet as you go. Make sure that your circled answers on the exam agree with those on the COVER sheet. Each question is worth 2.5 points.

1. In many enzymes, there is a metal cofactor required to catalyze the reaction of interest. If the metal were to absent from the enzyme, it would be referred to as a(n):

 - A) holoenzyme.
 - B) prosthetic group.
 - C) apoenzyme.
 - D) coenzyme.
2. Enzymes are potent catalysts. They:

 - A) drive reactions to completion while other catalysts drive reactions to equilibrium.
 - B) are consumed in the reactions they catalyze.
 - C) are very specific and can prevent the conversion of products back to substrate.
 - D) lower the activation energy for the reactions they catalyze.
3. Which of the following kinetic parameters remains constant, whether a reaction is catalyzed or uncatalyzed?

A) k B) V_{\max} C) V_0 D) K_{eq}

4. The benefit of measuring the initial rate of a reaction, V_0 , is that at the beginning of a reaction:

A) **relative changes in [S] are negligible, so [S] can be treated as a constant.**

B) [ES] can be accurately measured.

C) $V_0 = V_{\max}$

D) changes in K_m are negligible, so K_m can be treated as a constant.

5. To determine V_{\max} from a double-reciprocal plot, you would:

A) take the reciprocal of the x-axis intercept.

B) multiply the reciprocal of the x-axis intercept by -1.

C) **take the reciprocal of the y-axis intercept.**

D) multiply the reciprocal of the y-axis intercept by -1.

6. Which of the following amino acid residues is not a part of the catalytic triad of chymotrypsin?

A) **threonine** B) histidine C) aspartic acid D) serine

7. Which of the following is not related to rate accelerations derived from the binding of substrate to enzyme?

A) desolvation of the substrate by the enzyme active site

B) reduction of entropy

C) **acid-base catalysis**

D) enzyme-substrate specificity

8. An enzyme inhibitor that affects both the values of K_m and V_{\max} for an enzyme is known as a(n)

A) competitive inhibitor.

B) **uncompetitive inhibitor.**

C) noncompetitive inhibitor.

D) irreversible inhibitor.

9. Which of the following cofactors does not aid in the catalysis of biological oxidation-reduction reactions?

A) NADH

B) $FADH_2$

C) ubiquinone

D) **coenzyme A**

10. What is the only vitamin derived cofactor to contain a metal center?

- _____ A) **cobalamin**
B) pyridoxal phosphate
C) tetrahydrofolate
D) biotin

11. What of the following is true about the role of thiamine pyrophosphate (TPP) in the decarboxylation of amino acids?

- A) TPP acts as a CO₂ carrier molecule.
B) TPP forms a high energy thioester intermediate.
_____ C) **TPP forms a highly nucleophilic carbanion.**
D) TPP forms a Schiff base

12. Which of the following is not a lipid soluble vitamin?

- A) vitamin A **B) vitamin C** C) vitamin D D) vitamin K

13. Which of the following is not an aldose?

- A) ribose B) glucose **C) fructose** D) glyceraldehyde

14. D-glucose is called a reducing sugar because it undergoes an oxidation-reduction reaction. One of the products of this reaction is:

- A) D-glucuronate
_____ **B) D-gluconate**
C) D-ribose
D) muramic acid

15. The homoglycan, chitin, is a polymeric chain of which monosaccharide?

- A) glucose B) galactose C) glucosamine **D) N-acetylglucosamine**

16. In glycoproteins, the carbohydrate group is always attached through the amino acid residues:

- A) tryptophan, aspartate or cysteine.
_____ **B) aspartate, serine or threonine.**
C) glycine, alanine or aspartate.
D) glutamine or arginine.

Part II (60 points)

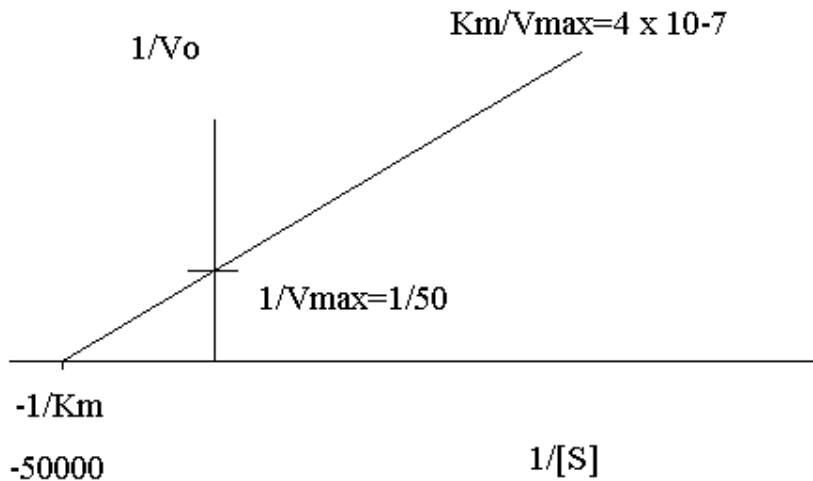
- Answers for Part II should be answered directly in the space given. Partial credit will be given on this part of the exam so remember to SHOW ALL WORK.

1. The following data were collected for an enzyme-catalyzed reaction. Determine the value of V_{max} and K_m and provide a brief explanation of how you arrived at your values. (6 pts)

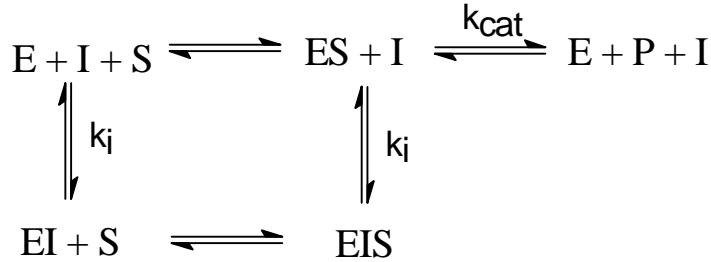
| Assay | [S], M | V_o , $\mu\text{mol}/\text{min}$ |
|-------|----------------------|------------------------------------|
| 1 | 1.0×10^{-5} | 15.6 |
| 2 | 2.0×10^{-5} | 24.9 |
| 3 | 1.0×10^{-4} | 40.8 |
| 4 | 2.0×10^{-4} | 43.6 |
| 5 | 1.0×10^{-3} | 49.5 |
| 6 | 1.0×10^{-2} | 50.0 |
| 7 | $1.0 \times 10^{+1}$ | 50.0 |

V_{max} is approximately 50 mmol/min since a 1000-fold increase in substrate has no effect on velocity. K_m can be approximated from experiment where V_o is one-half of 50 (25 mmol/min) and that yields a K_m of 2.0×10^{-5} M.

- b. Sketch the Lineweaver-Burk plot for the above data with appropriate labels on each axis (i.e. values of intercepts, slope, axis labels). (6 pts)

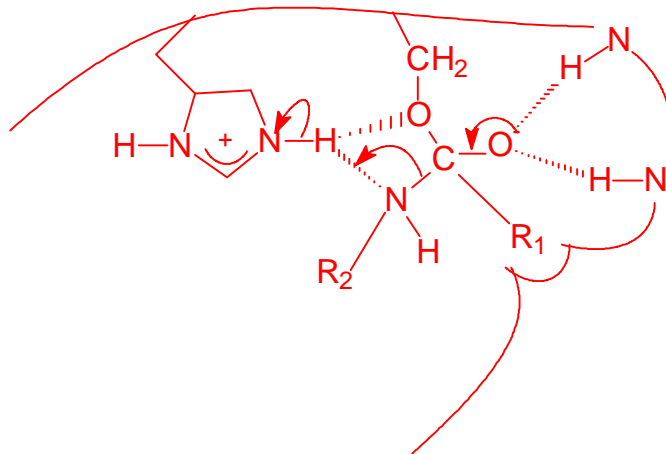
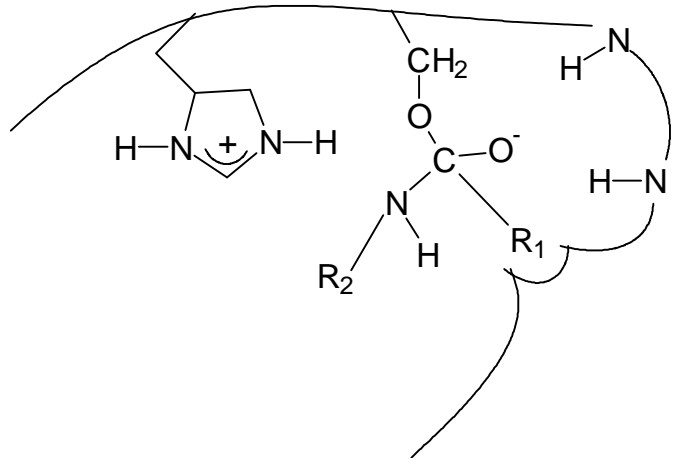


2. Using the reaction scheme provided below, explain how a noncompetitive inhibitor can affect the value of V_{max} without changing the value of K_m . (8 pts)



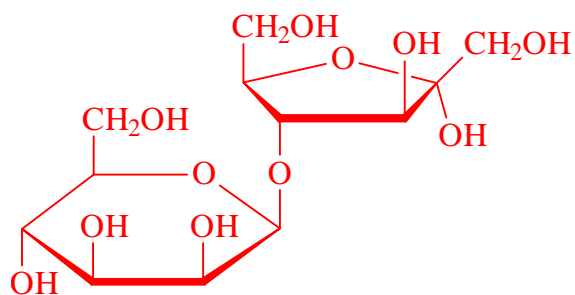
Both E and EI are equally capable of binding S, therefore the concentration of S required to bind one-half the total molecules of enzyme does not change.

3. The adjacent figure below represents the transition state of a bound peptide in a serine protease. Indicate on the figure all the possible hydrogen bonding interactions and show what happens next in the reaction mechanism. (12 pts)

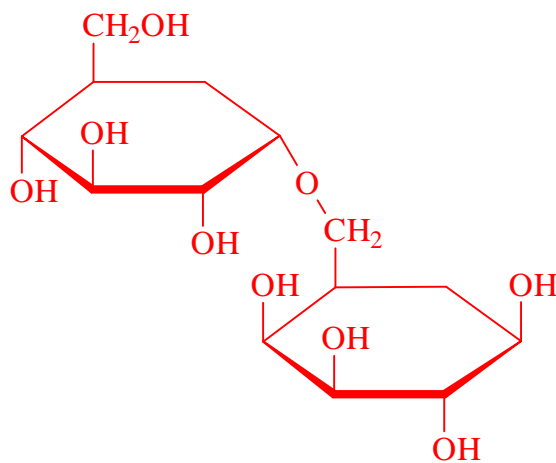


4. Draw the correct structures for the following carbohydrates (14 pts):

a. β -D-mannopyranosyl (1 \rightarrow 4)- α -D-fructofuranose

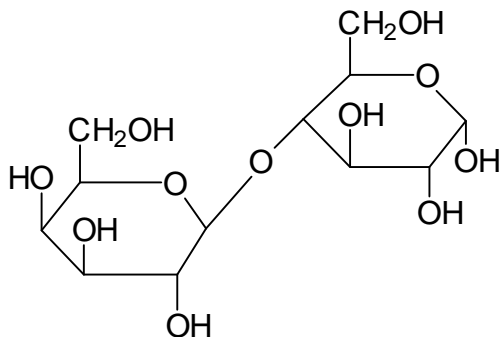


b. α -D-glucopyranose (1 \rightarrow 6) β -D-galactopyranose



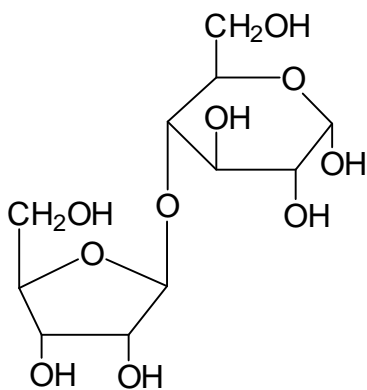
5. Give the complete name for the following structures (14 pts):

a.



β -D-galactopyranose (1->4) α -D-glucopyranose

b.



β -D-ribofuranose (1->4) α -D-glucopyranose