Name_____

EXAM 2
FORM B

Place your name at the top of this page of the exam. On the F-1712 Scantron form, use a no. 2 pencil to enter your test form designation, i.e., A or B. Also print and encode your name and the last your UTD ID (starting in the first column on the left and leaving the last spaces blank). Leave phone number, code and subject score sections blank.

Select the best answer for the following multiple-choice questions and enter the corresponding letter on the Scantron sheet. You may use these test pages to make notes and work problems.

You may use a non-graphing calculator or a graphing calculator you have cleared of all stored data.

When finished, turn in this exam along with your Scantron sheet.

1. Which of the following is true for an uncompetitive inhibitor?
    a. it can bind equally well to either the free enzyme or the ES complex
    b. it binds to the free enzyme better than to the ES complex
    c. it binds to the ES complex better than to the free enzyme
    d. it can bind only to the ES complex
    e. it can bind only to the free enzyme

2. Which of the following is a way enzymes catalyze reactions?
    a. lowering the Arrhenius activation energy
    b. forming better weak interactions with the substrate than with the transition state
    c. donating a proton to the substrate
    d. a & c
    e. all of the above

3. For an enzyme that obeys Michaelis-Menten kinetics, what is the V_{max} value in μmoles/min
    if v = 25 μmoles/min when [S] = K_m ?
    a. 50 μmol/min
    b. 70 μmol/min
    c. 100 μmol/min
    d. 155 μmol/min
    e. 200 μmol/min

4. How many turns of an α-helix can be formed by 12 amino acid residues?
    a. 7.2
    b. 3.3
    c. 10.8
    d. 6.0
    e. 9.0

5. An assay containing 100 nM of a Michaelis enzyme with K_m of 2.5 x 10^{-6} M and a saturating concentration of substrate showed a V_{max} of 33 μM/min. What will the V_{max} be if the enzyme concentration is increased to 175 nM?
    a. 23 μM/min
    b. 44 μM/min
    c. 58 μM/min
    d. 145 μM/min
    e. 175 μM/min

6. Organophosphorus insecticides such as malathion and parathion are nontoxic to humans because our microsomal enzymes catalyze their
    a. linkage to glutamic acid
    b. reduction
    c. modification by replacement of a phosphorus-bound sulfur with oxygen
    d. hydrolysis
    e. acetylation

7. The secondary structure of proteins is dominated by
    a. collagen-like helices and β strands
    b. α helices and β strands
    c. π helices and β strands
    d. φ and ψ helices
    e. α and π helices

8. For a bisubstrate reaction, a Lineweaver-Burk plot consisting of a set of parallel lines is characteristic of
    a. a single displacement reaction.
    b. a random double displacement reaction.
    c. a ping pong BiBi reaction
    d. an ordered triple displacement reaction
    e. none of the above.

9. Proteases can be classified according to the amino acid residues in their active sites which directly catalyze peptide hydrolysis. Which of the following does NOT represent a class of proteases?
    a. serine
    b. aspartate
    c. methionine
    d. threonine
    e. cysteine

10. Which of the following is one of the six major classes of enzymes as designated by the International Union of Biochemistry?
    a. lysozyme
    b. anhydrase
    c. aldolase
    d. lyase
    e. epimerase

11. In the active site of carbonic anhydrase, a zinc cation
    a. generates OH^- at physiological pH
    b. is coordinated in three of four positions to side chains of amino acid residues
    c. transiently links to the C of carbon dioxide
    d. a & b
    e. all of the above

12. In the presence of 1 x 10^{-3} M competitive inhibitor, an enzyme exhibits an apparent K_m of 2 x 10^{-4} M. If the K_I of the inhibitor is 1 x 10^{-7} M, what is the true K_m of the enzyme?
    a. 2 x 10^{-8} M
    b. 2 x 10^{-7} M
    c. 2 x 10^{-6} M
    d. 2 x 10^{-4} M
    e. 2 x 10^{-3} M

13. Which of the following amino acids can serve as a general acid-base catalyst in an enzyme active site?
    a. Ala
    b. Asp
    c. Met
    d. a & b
    e. b & c

14. The Hsp70 proteins assist in protein folding by
    a. catalyzing cis-trans isomerization of peptide bonds to proline
    b. templating the folding
    c. binding to exposed hydrophobic regions of nascent polypeptides
    d. keeping charged side chains from forming nonproductive interactions
    e. forming molecular vessels in which proteins can fold in isolation

15. Enzymes that are classified as ligases
    a. include those called synthetases
    b. catalyze coupled reactions
    c. utilize energy from ATP hydrolysis to drive the reaction
    d. a and b
    e. all of the above

16. The catalytic triad Asp His Ser is found in the active site of chymotrypsin.
    a. true
    b. false

17. Intrinsically unstructured proteins adopt well-defined structures in complexes with their target proteins.
    a. true
    b. false

18. What is the transition state geometry of the carbonyl carbon of a peptide bond during HIV protease or papain-catalyzed hydrolysis?
    a. tetrahedral
    b. trigonal
    c. pentagonal
    d. planar
    e. hexagonal

19. What is the K_m for a Michaelis enzyme if the 1/[S] intercept is -4.0 x 10^5 M^{-1} on a Lineweaver-Burk plot of its reaction kinetics?
    a. 5.0 x 10^{-7} M
    b. 2.5 x 10^{-6} M
    c. 1.0 x 10^{-6} M
    d. 2.5 x 10^{-4} M
    e. 1.0 x 10^{-3} M

20. Lineweaver-Burk plots can be used to
    a. distinguish types of reversible inhibitors
    b. determine K_m values
    c. determine K_I values
    d. a and b
    e. all of the above

21. What is the spatial arrangement of the 6 atoms that comprise a peptide bond?
    a. C_α atoms usually in trans configuration
    b. hexagonal
    c. planar
    d. a and b
    e. a and c

22. Five competitive inhibitors of an enzyme were found to exhibit the following K_I values. Which is the best inhibitor?
    a. $K_I = 6 \times 10^{-4}$ M
    b. $K_I = 3 \times 10^{-5}$ M
    c. $K_I = 5 \times 10^{-5}$ M
    d. $K_I = 7 \times 10^{-6}$ M
    e. $K_I = 1 \times 10^{-8}$ M

23. A Ramachandran plot allows the dissociation constants and number of binding sites for a protein ligand to be determined.
    a. true
    b. false

bonus question
24. The cellular concentration of the substrate of an enzyme is usually 100 times less than its K_m value
    a. true
    b. false

25. For a Michaelis enzyme, $k_1 = 2.0 \times 10^9$ M^{-1} s^{-1}, $k_{-1} = 5.0 \times 10^4$ s^{-1}, and $k_2 = 4.0 \times 10^3$ s^{-1}. What is its K_m?
    a. 18 μM
    b. 27 μM
    c. 75 μM
    d. 54 μM
    e. 3.7 μM

26. Which of the following is NOT true for the collagen helix?
    a. frequently found in globular proteins
    b. left-handed
    c. comprised of long segments where every third residue is gly
    d. forms a three-stranded right-handed helix
    e. contains hydroxyproline

27. Which of the following can irreversibly denature a protein?
    a. urea
    b. heat
    c. polar surfactants such as Triton X-100
    d. a and c
    e. all of the above

28. Which protein secondary structure has the lowest pitch, i.e., rise per turn?
    a. α helix
    b. β bend
    c. collagen helix

29. Michaelis enzymes exhibit a hyperbolic curve on a plot of v_o vs. [S].
    a. true
    b. false

30. In general base catalysis, withdrawal of H^+ from the substrate is later followed by donation of H^+ to create a product.
    a. true
    b. false

bonus question
31. The peptide bonds of proteins are made by a ribosomal RNA catalyst, i.e., a ribozyme.
    a. true
    b. false

32. Viagra and similar erectile dysfunction drugs are analogs of cGMP. What type of inhibitor are they?
    a. irreversible
    b. reversible, classic noncompetitive
    c. reversible, mixed noncompetitive
    d. reversible, competitive
    e. reversible, uncompetitive

33. For a Michaelis-type enzyme, if the v_o / V_{max} ratio is 2/3 when $[S] = 1 \times 10^{-3}$ M, what will be its K_m?
    a. 5.0×10^{-4} M
    b. 5.0×10^{-5} M
    c. 6.7×10^{-4} M
    d. 6.7×10^{-5} M
    e. 1.5×10^{-4} M

34. The barrel, sandwich, and propeller structures which often are the foundations of protein domains are formed predominantly from which type of secondary structure?
    a. α
    b. β
    c. γ
    d. π
    e. ψ