BIOL/CHEM 3361 Name_____

EXAM 2

You will also need to be able to draw and label (axes and intercepts) of diagnostic Lineweaver-Burk plots for inhibitors

1. Some non-serine proteases contain the following catalytic moiety
   a. Asp
   b. Cys
   c. Arg
   d. a and b
   e. all of the above

3. The enzyme that catalyzes the following reaction belongs to which enzyme class?

$^{-}O_2CCH=CHCO_2^{-} + H_2O \rightarrow {}^{-}O_2CCH(OH)CH_2CO_2^{-}$

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

5. The β-α-β super-secondary structure is often used to form
   a. coiled coils
   b. β-hairpins
   c. β-barrels
   d. a & c
   e. b & c

6. The chaperones hsp60 and hsp70
   a. degrade incorrectly folded proteins
   b. serve as templates for protein folding
   c. use the energy from ATP cleavage to catalyze protein folding
   d. only help proteins fold correctly after heat shock

7. Predicting secondary structure from primary structure based only on the probabilities with which amino acids are found in the various secondary structures of known proteins is
   a. accurate most of the time
   b. no better than 50% accurate
   c. almost never accurate
   d. is the best that can be done at present

8. The ψ angle refers to the amount of rotation about which bond(s) in the peptide backbone?
   a. N-C_α
   b. C_α-$C_{carbonyl}$
   c. $C_{carbonyl}$-N
   d. a & b
   e. a & c

9. Parallel beta sheets are found most frequently in the interior of proteins because:
   a. the hydrogen bonds between strands in parallel sheets aren't straight

b. the side chains of the residues which form parallel sheet have less steric hindrance
c. not all of the peptide carbonyls in parallel sheets can participate in H-bonding
d. all of the above

10. Proline is unique among the amino acids because
a. it is the only amino acid whose alpha carbon is not chiral
b. it exists naturally in two diastereomeric forms
c. its φ angle is fixed
d. its alpha amino group is a tertiary amine

11. Which of the following factors will influence the native conformation of a protein?
a. pH of the solution
b. concentration of salt in solution
c. sequence of the protein
d. all of the above
e. a and c

12. How many more amino acid residues are present in a 5 nm long α-helix than in a β-strand of the same length
a. 12
b. 15
c. 20
d. 25

13. Urea and guanidinium chloride denature proteins
a. irreversibly by reacting with asn residues
b. reversibly by competing for water of hydration
c. by disrupting the structure of water and forming hydrogen bonds with the polypeptide
d. by extensive van der Waal's interactions with the protein
e. none of the above

14. Consider the oligopeptide, AEFGLKMEP, which is on the surface of a protein. What secondary structure would you predict for this peptide?
a. α helix
b. β conformation
c. γ helix
d. collagen helix

15. Which of the following is not characteristic of collagen?
a. a 4.4-fold left-handed helix is the basic structural conformation
b. about 33% of the amino acid residues are glycine
c. its secondary structure is a polyproline type
d. many prolines are modified to hydroxyproline

17. Which of the designations listed below does not correspond to a major class of enzymes as outlined by the International Union of Biochemistry?
a. hydrolases
b. transferases
c. carboxylases
d. isomerases

18. Phosphofructokinase, which catalyzes the reaction below, is classified as a

$$\text{fructose-6-PO}_4 + \text{ATP} \rightarrow \text{fructose-1,6-bisPO}_4 + \text{ADP}$$

a. ligase
b. transferase
c. isomerase
d. hydrolase
e. carboxylase

20. A competitive inhibitor ($K_I = 1 \times 10^{-5}$ M) binds to an enzyme that has a true $K_m = 1 \times 10^{-6}$ M for its substrate and a V_{max} of 1×10^{-4} moles/min. Calculate the apparent K_m value in the presence of 1×10^{-3} M inhibitor.
a. 1×10^{-7} M
b. 1×10^{-6} M
c. 1×10^{-5} M
d. 1×10^{-4} M
e. 1×10^{-3} M

21. What is the maximum velocity that could be observed in the presence of the competitive inhibitor in the previous problem?
a. 1×10^{-7} mol/min
b. 1×10^{-6} mol/min
c. 1×10^{-5} mol/min
d. 1×10^{-4} mol/min
e. 1×10^{-3} mol/min

22. Assume the inhibitor in the question above is a classic noncompetitive inhibitor. What is the apparent K_m value in the presence of 1×10^{-3} M inhibitor?
a. 1×10^{-7} M
b. 1×10^{-6} M
c. 1×10^{-5} M
d. 1×10^{-4} M
e. 1×10^{-3} M

23. 12. If $V_{max} = 140$ µmol/min and $v_o = 70$ µmol/min at 70 µM substrate for an enzyme that obeys Michaelis-Menten kinetics, what is its K_m?
a. 50 µM
b. 70 µM
c. 140 µM
d. 175 µM

24. For another enzyme that obeys Michaelis-Menten kinetics, what is the V_{max} value in µmoles/min if v = 70 µmoles/min when [S] = 0. 5 K_m ?
a. 25 µmol/min
b. 70 µmol/min
c. 140 µmol/min
d. 210 µmol/min

25. Calculate the ratio $[S]/K_m$ when the velocity of an enzyme catalyzed (no inhibitor) reaction is 10% of V_{max}.
a. 1/6

b. 1/3
c. 1/9
d. 8/9

26. Given a turnover number of 1 x 10^3 s^{-1} and K_m of 2 x 10^{-3} M for an enzyme, how much less efficient would the enzyme be than the best known enzymes, i.e., perfected enzymes?
a. 10 times
b. 10^2 times
c. 10^5 times
d. 10^7 times

27. A ping pong bisubstrate reaction is
a. a single dislacement reaction
b. a double displacements reaction
c. not easily distinguished by its kinetics
d. a and b
e. b and c

28. Which of the following statements is true about Michaelis-Menten enzymes?
a. They never have more than one subunit
b. They always follow rapid equilibrium kinetics
c. They never have allosteric effectors
d. a and c
e. all of the above

29. The Briggs and Haldane steady state assumption rests on the premise that
a. the concentration of enzyme-substrate complex does not change
b. the product concentration is insignificant
c. the substrate concentration is large and does not change significantly
d. the free enzyme concentration is always in great excess to the concentration of the enzyme-substrate complex

30. Reversible inhibitors of enzyme-catalyzed reactions can be characterized by examining double reciprocal plots of reaction kinetics. In the case of mixed-type noncompetitive inhibition, the presence of the inhibitor yields a curve that
a. crosses the 1/v axis at the same intercept as in the absence of the inhibitor
b. crosses the 1/[S] axis at the same intercept as in the absence of the inhibitor
c. crosses the 1/[S] axis at a point different than that in the absence of the inhibitor
d. is parallel to the curve determined in the absence of the inhibitor

31. The K_m/K_i ratio for a transition state analog that is an effective reversible inhibitor will be
a. less than 1
b equal to 1.
c. greater than 1
d. a, b, or c depending upon whether the enzyme has rapid equilibrium kinetics

32. Lineweaver-Burk plots are
a. semi-log plots used to determine K_m values
b. used determine the number of substrate binding sites n distinguish between single and double displacement reaction mechanisms
c. used to distinguish ordered from random single displacement bisubstrate reactions
d. used to evaluate $\Delta G^{\ddagger}$

e. double reciprocal plots used to determine V_{max}

33. Four competitive inhibitors of an enzyme were found to exhibit the following K_I values. Which is the best inhibitor?
a. $K_I = 1 \times 10^{-2}$ M
b. $K_I = 7 \times 10^{-11}$ M
a. $K_I = 5 \times 10^{-9}$ M
b. $K_I = 3 \times 10^{-5}$ M

34. The cellular concentration of the substrate of an enzyme is very often found to be
a. much greater than its K_m value
b.much less than its K_m value
c. approximately equal to its K_m value
d. equal to k_{cat}/K_m

36. The organophosphorus nerve gases, such as sarin, and insectides, such as malathion,
a. irreversibly inactivate acetylcholine esterase by forming a stable covalent bond with serine
b. inhibit acetylcholine esterase by transferring a phosphate group to the protein
c. are strong competitive inhibitors of acetylcholine esterase
d. must first be hydrolyzed in order to be active

37. Anti-freeze is toxic because alcohol dehydrogenase participates in the conversion of ethylene glycol in the anti-freeze to oxalic acid, which precipitates in the kidneys. The same enzyme is responsible for the toxicity of methanol by converting methanol to
a. cyanide
b. formaldehyde
c. formic acid
d. dimethyl ketone

38. The catalytic rate constant k_{cat} is
a. the rate at which substrate binds to an enzyme
b. a measure of the affinity of an enzyme for substrate
c. a constant evaluated by a Scatchard plot
d. the forward rate constant for the rate limiting step of an enzyme

39. The unstable covalent intermediate in the chymotrypsin-catalyzed reaction contains a bond formed between
a. serine and the carbonyl carbon in the peptide backbone
b. serine and the nitrogen in the peptide backbone
c. histidine and the carbonyl carbon in the peptide backbone
d. histidine and the nitrogen in the peptide backbone