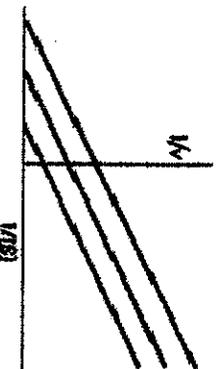


9. In sickle cell hemoglobin, a Glu is mutated to a _____. This causes the formation of _____ between hemoglobin molecules, ultimately forming large aggregates.
A) Arg; salt bridges B) Cys; disulfide bonds C) Val; hydrophobic interactions
D) Pro; disrupted α -helix, resulting in several H-bonds and salt bridges
E) none of the above
10. Which amino acid is often referred to as a "helix-breaker" due to its absence from α -helices but is often found in structures such as β -turns?
A) Val B) Met C) Pro D) Phe E) Leu
11. Since an enzyme is a catalyst, which of the following must be true?
A) an enzyme-catalyzed reaction is always exergonic
B) enzymes increase the rate of a reaction by providing a completely alternate mechanism to the uncatalyzed reaction
C) over the course of an enzyme-catalyzed reaction, the enzyme is not changed
D) in the absence of an enzyme, the reaction that is normally catalyzed by the enzyme will not occur
E) enzyme-catalyzed reactions never reach equilibrium
12. Which of the following explains why enzymes are extremely effective catalysts?
A) an enzyme stabilizes the transition state
B) enzymes bind very tightly to substrates
C) enzymes release products very rapidly
D) an enzyme can convert a normally endergonic reaction into an exergonic reaction
E) an enzyme lowers the energy of activation only for the forward reaction
13. The steady state assumption in enzyme kinetics:
A) insures that the product of an enzymatic reaction will always be formed
B) explains why enzymes are effective catalysts
C) states that the formation of ES is equal to its breakdown
D) is based upon the fact that the maximum velocity of an enzyme is very high
E) none of the above
14. In a Lineweaver-Burke plot, what does the slope represent?
A) K_M B) V_{max} C) V_{max}/K_M
D) K_M/V_{max} E) none of the above
15. What are the expected changes in kinetics in the presence of a **competitive inhibitor**?
A) V_{max} decreases, K_M appears to decrease B) V_{max} does not change, K_M appears to decrease
C) V_{max} decreases, K_M appears to increase D) V_{max} does not change, K_M appears to increase
E) V_{max} decreases, K_M does not change.

16. What type of inhibitor would give the results seen in the following plot?



- A) competitive inhibitor B) mixed inhibitor C) noncompetitive inhibitor
D) uncompetitive inhibitor E) none of the above

17. An enzyme that catalyzes the intramolecular movement of a functional group from one carbon atom to another would be called a(n) _____.

- A) isomerase B) transferase C) oxidoreductase D) kinase E) ligase

18. Since the product of the reaction catalyzed by hexokinase, glucose-6-phosphate (G6P), can act as both a competitive and uncompetitive inhibitor, what can be said about the interaction between G6P and hexokinase?

- A) G6P binds only to active site of the enzyme
B) G6P binds only to a regulatory site of the enzyme
C) G6P binds to both the active site and a regulatory site of the enzyme
D) G6P binds to one of the substrates, ATP, thus preventing ATP from binding to the active site
E) none of the above

19. What term describes an inactive precursor of an enzyme such as the precursors to protease enzymes produced by the pancreas?

- A) allosteric enzyme B) zymogen C) isozyme
D) ribozyme E) hydrolase

20. What solution conditions are required for a protein to be a positively charged macroion?

- A) pH of solution is greater than the protein's pI
B) pH of solution is less than the protein's pI
C) pH of solution is greater than the protein's pI and ionic strength is low
D) pH of solution is less than the protein's pI and ionic strength is low
E) none of the above

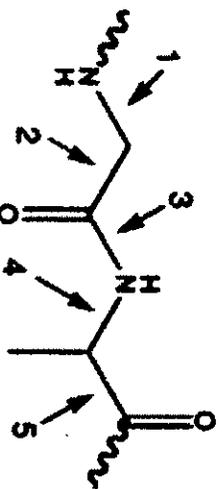
21. At physiological pH, most amino acids are _____, meaning that they contain both a positive and negative charge.

- A) zwitterions B) amphoteric C) chiral
D) amphipathic E) none of the above

22. The binding of oxygen to hemoglobin is said to be _____.

- A) high affinity B) low affinity C) sigmoidal
D) cooperative E) sequential

23. Which of the following bonds has partial double bond character?



A) 1 B) 2 C) 3 D) 4 E) 5

24. Which of the following would contribute to tertiary structure?

- A) charge-charge interaction between lysine and aspartic acid
- B) disulfide bond
- C) hydrogen bond between serine hydroxyl group and amide of glutamine
- D) hydrophobic interaction between leucine and valine
- E) all of the above

25. The β cells of the islets of Langerhans secrete _____ in response to _____ glucose levels in the muscle and/or adipose tissue.

- A) insulin; low B) insulin; elevated C) glucagon; low
- D) glucagon; elevated E) somatostatin; elevated

II. Essays

1. Describe the function and the role of Na^+K^+ ATPase in animal cells (5%)
2. Calculate the number of ATP molecules obtained from the anaerobic conversion of each of the following compounds to pyruvate:
 - (1) glucose (3%)
 - (2) phosphoenolpyruvate (3%)
3. Describe the structural differences between amylose and amylopectin. (5%)
4. Nucleotides play a variety of roles in the cell. Give an example of a nucleotide that acts in each of the following roles or processes.
 - (a) Second messenger in signal transduction (1%)
 - (b) Phosphoryl-group transfer during metabolism (1%)
 - (c) Activation of acetyl groups in biosynthesis of fatty acid (1%)
 - (d) Transfer of electrons in oxidative phosphorylation (1%)
 - (e) Activation of glucose during glycogen synthesis (1%)
5. Briefly outline the steps for fatty acid β -oxidation. (5%)

6. Are the acetyl carbons that enter the citric acid cycle the exact same carbons that leave as CO₂? Briefly explain. (5%)

7. (A) cytosol
(B) mitochondrion
(C) endoplasmic reticulum
(D) glyoxysome

Use the above sub-cellular compartments to match the location for the following metabolisms in mammals:

1. _____ glycolysis (1%)
2. _____ fatty acid β -oxidation (1%)
3. _____ biosynthesis of fatty acids (1%)
4. _____ gluconeogenesis (1%)
5. _____ ketone body synthesis (1%)
6. _____ citric acid cycle (1%)
7. _____ fatty acid desaturation (1%)
8. _____ glyoxylate cycle(1%)
9. _____ phospholipids synthesis (1%)
10. _____ fatty acid elongation (1%)

8. List two non-essential fatty acids. (4%)

9. Give five non-essential amino acids. (5%)