

- A. Multiple Choices (34%, 2% each; one correct answer only)**
1. If you wanted to describe K_m to a person who had little biochemical background, you could tell them to think of it as:
 - A. Half the maximum velocity of the saturated enzyme
 - B. Half the activation energy
 - C. The substrate concentration which produces half the maximum velocity
 - D. Substrate concentration
 - E. The way the substrate fits an inhibitor
 2. Many of the reactions that occur in our body require energy. This means that the ΔG of life appears to be positive and thus, the reactions are unfavorable and shouldn't occur. How is it that life still occurs?
 - A. Unfavorable reactions (+ ΔG) are coupled with favorable reactions (- ΔG).
 - B. All reactions that occur within the body have a - ΔG .
 - C. In the body, enzymes catalyze reactions that have a + ΔG .
 - D. There are no energy requiring processes within the body.
 - E. All reactions in the body are catabolic.
 3. The presence of a certain enzyme inhibitor increased the K_m of the enzyme but did not lower the maximum velocity. The inhibitor was:

A. An enzyme poison	B. A competitive inhibitor
C. A noncompetitive inhibitor	D. An uncompetitive inhibitor
E. An enzyme activator	
 4. The zwitterion form of alanine:
 - A. Is the form which exists in a solution having a pH of 7.0
 - B. Is the form which has no charges whatsoever
 - C. Is the form present in acidic solution
 - D. Is the form you'd find in basic solutions
 - E. Has a charge of -1
 5. Hemoglobin is made up of two α chains and two β chains. The maximum degree of protein structure shown by hemoglobin is:

A. Quaternary	B. Primary	C. Tertiary
D. Secondary	E. Nonpolar	
 6. Which of the following protein-modifying reagents generally used as a sulfhydryl-modifying reagent
 - A. Chymotrypsin
 - B. Cyanogen bromide
 - C. Iodoacetamide
 - D. Phenylglyoxal
 - E. Pyridoxal 5'-phosphate

7. On the x and y axes of a Lineweaver-Burk plot, the largest values of substrate concentration will be found:
- A. At the top of the y axis
 - B. At the intercept on the y axis
 - C. At the right end of the x axis
 - D. At the intercept on the x axis
 - E. At the origin
8. The Bohr effect describes the affect of pH on binding of oxygen by hemoglobin. In general, this effect:
- A. Provides a mechanism by which hemoglobin binds oxygen tightly in the presence of carbonic acid in muscles
 - B. Provides an explanation for the release of oxygen at high pH in lung tissue
 - C. Provides a mechanism for the binding of hemoglobin and oxygen at low pH in lung
 - D. Provides an explanation for the release of oxygen at low pH in muscle tissue
 - E. Provides a link between oxygen consumption and respiration
9. A peptide was found to have a molecular mass of about 650 and upon hydrolysis produced Ala, Cys, Lys, Phe, and Val in a 1:1:1:1:1 ratio. The peptide upon treatment with Sanger's reagent produced DNP-Cys and exposure to carboxypeptidase produced valine. Chymotrypsin treatment of the peptide produced a dipeptide that contained sulfur and has a UV absorbance, and a tripeptide. Exposure of the peptide to trypsin produced a dipeptide and a tripeptide. Deduce the sequence of the peptide.
- A. Val-Ala-Lys-Phe-Cys
 - B. Cys-Lys-Phe-Ala-Val
 - C. Cys-Ala-Lys-Phe-Val
 - D. Cys-Phe-Lys-Ala-Val
 - E. Val-Phe-Lys-Ala-Cys
10. Which of the following amino acids **does not** play an important role in the active site of serine proteases?
- A. Lysine
 - B. Serine
 - C. Histidine
 - D. Aspartate
 - E. None of the above
11. Which is true regarding the orientation of the R-groups in β structures?
- A. In the parallel β sheet structures the amino acid R-groups are all on the same side of the sheet.
 - B. In the antiparallel β sheet structure the R-groups on alternate strands are on the same side of the sheet.
 - C. In parallel and antiparallel sheets consecutive R-groups on each peptide strand alternate sides of the sheet.
 - D. Because of the free rotation around the α carbon, the R-groups can seek the least crowded region and are not restricted to a specific side of the sheet.
 - E. A and B
12. A holoenzyme is
- A. a coenzyme
 - B. an enzyme with its cofactor
 - C. an enzyme lacking its cofactor
 - D. an allosteric enzyme
 - E. a cofactor

13. An alpha-helical conformation of a globular protein in solution is best determined by which of the following?
- A. Ultraviolet-visible absorbance spectroscopy
 - B. Fluorescence spectroscopy
 - C. Electron microscopy
 - D. Analytical ultracentrifugation
 - E. Circular dichroism
14. Hydrophobicity profile of a protein can be calculated from its _____ protein structure.
- A. primary
 - B. secondary
 - C. tertiary
 - D. quaternary
15. Allosteric inhibition of an enzyme involves which of the following?
- A. Binding of an inhibitor to a site other than the substrate binding site
 - B. Binding of an inhibitor competitively to the substrate binding site
 - C. Binding of an inhibitor noncompetitively to the substrate binding site
 - D. Cooperative binding of substrate to an enzyme with four or more subunits
 - E. Cooperative binding of substrate to an enzyme that does not deviate from normal Michaelis-Menten kinetics
16. In a plot of $1/V$ against $1/[S]$ for an enzyme-catalyzed reaction, the presence of a competitive inhibitor will alter the:
- A. V_{max}
 - B. intercept on the $1/V$ axis.
 - C. intercept on the $1/[S]$ axis.
 - D. curvature of the plot.
 - E. pK of the plot.
17. If sucrose and monosodium glutamate (MSG) are added to a vinegar and oil salad dressing and shaken, the mixture will eventually separate into two phases of different density and polarity. Where will most of the sucrose and the MSG be located following phase separation?
- A. Both will concentrate in the vinegar.
 - B. Both will concentrate in the oil.
 - C. Both will concentrate at the interface.
 - D. Sucrose will concentrate in the oil and MSG will concentrate in the vinegar.
 - E. Sucrose will concentrate in the vinegar and MSG will concentrate in the oil

B. Essay

1. Briefly describe the various functions by protein performed in a cell. (6%)
2. Nucleotides play a variety of roles in the cell. Give an example of a nucleotide or the nucleotide derivative that acts in each of the following roles or processes.
 - (a) Second messenger (2%)
 - (b) Phosphoryl-group transfer (2%)
 - (c) Activation of acetyl groups (2%)
3. Give two essential fatty acids and their structures. (6%)

4. Explain why mutations in oncogenes are generally dominant while those in tumor suppressor genes are recessive. (6%)
5. Describe the importance of phosphorylated intermediates in glycolysis. (6%)
6. Are the acetyl carbons that enter the citric acid cycle the exact same carbons that leave as CO₂? Briefly explain. (6%)
7. Give three reagents that can inhibit blood coagulation (3%). Explain why? (3%)
8. What is the effect of each of the following treatments on the oxygen affinity of hemoglobin A *in vitro*?
 - (a) Increase in pH from 7.0 to 7.4. (2%)
 - (b) Increase in [BPG] from 0.2 to 2.0 mM. (2%)
 - (c) Dissociation of $\alpha_2\beta_2$ into monomer subunits. (2%)
9. What structural differences characterize starch and cellulose? (6%)
10. List three essential amino acids and their structures. (6%)
11. Give three primary active transporters. Their functions are regulated by phosphorylation. (6%)