Part I. Choose the right answer or answers (5% × 10 = 50%).

1. Which of the following amino acids has/have a charged side chain at physiologic pH? (A) Aspartic acid. (B) Lysine. (C) Glutamic acid. (D) Asparagine.

2. Which one of the following types of bonds or interactions is least important in determining the three-dimensional folding of most proteins? (A) Hydrogen bonds. (B) Electrostatic bonds. (C) Hydrophobic interactions. (D) Disulfide bonds. (E) Ester bonds.

3. Which of the following compounds can be produced from dietary starch by salivary α-amylase? (A) Maltose. (B) Starch dextrins. (C) Isomaltose. (D) Fructose.

4. Under physiologic conditions, each of the following contains a high-energy phosphate group EXCEPT (A) ATP. (B) ADP. (C) AMP. (D) phosphoenolpyruvate. (E) phosphocreatine.

5. The conversion of 1 mole of isocitrate to 1 mole of succinate by the citric acid cycle results in the formation of how many moles of high-energy phosphate? (A) 3. (B) 5. (C) 6. (D) 7. (E) 8.

6. Which one of the following compounds is a precursor in the biosynthesis of cholesterol? (A) Cholesterol. (B) Progesterone. (C) Lanosterol. (D) Cholic acid. (E) Pregnenolone.

7. Which of the following is(are) heme proteins? (A) Catalase. (B) Hemoglobin. (C) Cytochrome oxidase. (D) Myoglobin.

8. Insulin does all of the following EXCEPT (A) enhance glucose transport into muscle. (B) enhance glycogen formation by liver. (C) decrease lipolysis in adipose tissue. (D) enhance gluconeogenesis in liver. (E) enhance amino acid transport into muscle.

9. The coenzyme required in oxidative decarboxylation is (A) biotin. (B) vitamin B₁₂. (C) pyridoxal phosphate. (D) ascorbic acid. (E) thiamine pyrophosphate.

10. Which of the following statements about DNA polymerases is(are) CORRECT? (A) DNA polymerases require primers. (B) DNA polymerases can add nucleotides at both the 3'- and the 5'-ends of the growing polynucleotide chain. (C) In addition to their polymerizing activity, DNA polymerases have a 3'→5'-exonuclease activity. (D) DNA polymerases can synthesize DNA only in the presence of an RNA template.
Part II. Answer the following questions:

1. What reaction do the two enzymes glucokinase and hexokinase catalyse? Why should the liver have glucokinase while brain and other tissues have hexokinase? (6%)

2. Explain the difference between aerobic and anaerobic glycolysis in muscle and the circumstances in which they occur. What is the point of anaerobic glycolysis? (5%)

3. What is meant by: (a) photophosphorylation? (b) cyclic photophosphorylation? (4%)

4. Eukaryotes have no topoisomerase capable of inserting negative supercoiling into DNA and yet eukaryote DNA is negatively supercoiled. Explain how this is brought about. (4%)

5. Describe the process of initiation of transcription of a gene in E. coli. (5%)

6. Compare and contrast the characteristics of four types of enzyme regulation: allosteryism, covalent modification, proteolytic cleavage, and isoenzymes. (8%)

7. You have isolated and purified an unknown protein from an insect. Its amino acid composition was determined after acid-catalyzed hydrolysis:

<table>
<thead>
<tr>
<th>Amino acid</th>
<th>%</th>
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<tbody>
<tr>
<td>Gly</td>
<td>45</td>
</tr>
<tr>
<td>Ala</td>
<td>30</td>
</tr>
<tr>
<td>Ser</td>
<td>12</td>
</tr>
<tr>
<td>Tyr</td>
<td>5</td>
</tr>
<tr>
<td>Val</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>6</td>
</tr>
</tbody>
</table>

Answer the following in questions about the unknown protein: (8%)

a. What is the expected secondary structure?

b. Is the protein fibrous or globular?

c. Do you expect the protein to be water-soluble?

d. Can you make some predictions about its biological function?
8. A deficiency of a citric acid cycle enzyme in both mitochondria and the cytosol of some tissue (e.g., blood lymphocytes) result in severe neurological abnormalities in newborns. The disease is characterized by excretion in the urine of abnormal large amounts of α-ketoglutarate, succinate, and fumarate. What enzyme deficiency would lead to these symptoms? (4%)

9. An enzyme that follows Michaelis-Menten kinetics has a $K_m$ of 1 μM. the initial velocity is 0.1 μM min$^{-1}$ at a substrate concentration of 100 μM. What is the initial velocity when [S] is equal to (a) 1 mM, (b) 1 μM, (c) 2 μM? (6%)