

I. Multiple Choice (2 points each, total 30 points)

1. The enzyme that catalyzes the following reaction belongs to which major classes?



- A. Transferases
 - B. Isomerases
 - C. Lyases
 - D. Hydrolases
 - E. Ligases
2. If a reaction catalyzed by an enzyme follows the Michaelis-Menten kinetics and has a reaction rate $v = (1/10)v_{\max}$, then $[S] = ? K_m$?
- A. 11
 - B. 9
 - C. 1/5
 - D. 1/9
 - E. 1/11
3. A mixture of amino acids, glutamic acid, valine, lysine, is applied to a column containing anion exchange resin and eluted with a buffer whose pH changes continuously from high to low. The order of amino acids flowing out of the column is
- A. glu, val, lys
 - B. lys, val, glu
 - C. val, glu, lys
 - D. glu, lys, val
 - E. lys, glu, val
4. In the complete oxidation of 1 mole of pyruvate through pyruvate dehydrogenase and TCA cycle, there will be a net production of
- A. 4 moles of NADH, 2 moles of FADH₂, and 1 mole of ATP.
 - B. 12 moles of ATP.
 - C. 4 moles of NADH, 1 mole of FADH₂, and 1 mole of ATP.
 - D. 10 moles of ATP.
 - E. 3 moles of NADH, 1 mole of FADH₂, and 1 mole of ATP.
5. Acetyl CoA is formed in mitochondria and the enzymes responsible for fatty acid synthesis are located in the cytoplasm. Which one of the following compounds is responsible for transporting acetyl CoA to across the mitochondrial membrane?
- A. fumarate
 - B. isocitrate
 - C. malate
 - D. citrate
 - E. none of the above

6. In eucaryotic cells, cytochrome P-450 are usually found the organelle of
- A. lysosome
 - B. micrososome
 - C. peroxisome
 - D. endoplasmic reticulum
 - E. mitochondria
7. The enzyme ribonucleotide reductase is essential for deoxyribonucleotide biosynthesis. Which one of the following reactions is NOT CATALYZED by this enzyme?
- A. TDP ----> dTDP
 - B. CDP ----> dCDP
 - C. UDP ----> dUDP
 - D. GDP ----> dGDP
 - E. ADP ----> dADP
8. Which one of the following codons is used as initiation codon in eucaryotic translation
- A. UUG
 - B. GUA
 - C. UGA
 - D. CUC
 - E. AUG
9. The DNA repair activity in eucaryotic cell is associated with
- A. DNA polymerase I
 - B. DNA polymerase alpha
 - C. DNA polymerase II
 - D. DNA polymerase beta
 - E. DNA polymerase III
10. DNA sequencing (the Sanger method) depends upon the termination of growing chains by
- A. puromycin
 - B. 2,3 dideoxynucleoside diphosphate
 - C. hydrazine
 - D. 2,3 dideoxynucleoside triphosphate
 - E. dimethylsulfate
11. The citric acid cycle is controlled by
- A. the intramitochondrial ratio of [NAD⁺] to [NADH]
 - B. the energy state of the cell
 - C. the redox state of the cell
 - D. the availability of energy-rich compounds
 - E. all of the above

12. The most active metabolic process in the early fasting state is
- A. Catabolism of amino acid.
 - B. lipolysis.
 - C. hepatic gluco-genolysis.
 - D. hepatic gluco-genogenesis.
 - E. glycolysis.
13. What is the pH of the buffer mixtures of 1 M acetic acid plus 0.5 M sodium acetate (Note: pK_a of acetic acid is 4.76, $\log 2 = 0.30$, $\log 3 = 0.48$, $\log 4 = 0.60$, $\log 5 = 0.70$)
- A. 1.76
 - B. 4.06
 - C. 4.46
 - D. 5.06
 - E. 7.76
14. Which one of the following statements is correct?
- A. actinomycin D binds to RNA polymerase
 - B. actinomycin D binds to DNA polymerase
 - C. actinomycin D binds to DNA
 - D. actinomycin D binds to RNA
 - E. actinomycin D binds to aminoacyl-tRNA
15. Which statements of glycogen phosphorylase of skeletal muscle is INCORRECT?
- A. active form of phosphorylase is phosphorylated.
 - B. addition of glucose decreases the enzyme catalytic activity.
 - C. the enzyme is consisted of dimeric proteins.
 - D. phosphatase catalyzes the conversion of inactive phosphorylase to active form.
 - E. phosphorylase cleaves and phosphorylates, releasing glucose-1-phosphate from glycogen.

II. Assay Question (10 points each, total 70 points)

1. Describe the Embden-Meyerhoff glycolytic pathway, and calculate how many molecules of ATP and NADH are formed.
2. Give two plant "lectins", and explain their binding target in cells.
3. Protein kinase C is one of the important protein kinases in the regulation of cell functions. Explain its activation mechanism in cells.
4. Ovalbumin is the major protein of egg white. The chicken ovalbumin gene contains eight exons separated by seven introns. Should one use ovalbumin cDNA or ovalbumin genomic DNA to form the protein in *E. Coli*? Why?

5. Low-density lipoprotein is the major risk factor in atherosclerosis. Describe its uptake pathway in human fibroblasts.
6. Collagen is the most abundant protein in human body. Describe its chemical structure briefly and indicate the specific amino acid in its structure, which is not observed in other proteins.
7. DNA polymerase I has three enzymatic activities in a single polypeptide chain. Indicate the three enzymatic activities and explain briefly.