

科目：生物化學

適用：應化系(生物醫學碩士班)

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

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**I. Single Choice (40%, 4% each)**

1. In order to examine the citric acid cycle, a pure preparation of isolated *intact* mitochondria is obtained. When add some succinyl-CoA to the suspension of mitochondria, how many moles of ATP would you expect to be generated in one turn of the citric acid cycle from each mole of succinyl-CoA added to the test tube?  
A) 3  
B) 4.5  
C) 5  
D) No ATP would form under these conditions
2. A compound that inhibits fumarase is identified. How many moles of ATP would be expected to be generated from one mole of acetyl-CoA in the presence of this inhibitor?  
A) 5  
B) 6  
C) 6.5  
D) 7.5
3. All the following enzymes are linked to the reduction of NADH *except*:  
A) Succinate dehydrogenase  
B) Isocitrate dehydrogenase  
C) Pyruvate dehydrogenase  
D) Lactate dehydrogenase
4. In the reoxidation of QH<sub>2</sub> by purified ubiquinone-cytochrome c reductase (Complex III) from heart muscle, the overall stoichiometry of the reaction requires 2 mol of cytochrome c per mole of QH<sub>2</sub> because:  
A) Succinate dehydrogenase cytochrome c is a one-electron acceptor, whereas QH<sub>2</sub> is a two-electron donor  
B) Cytochrome c is a two-electron acceptor, whereas QH<sub>2</sub> is a one-electron donor  
C) Cytochrome c is water soluble and operates between the inner and outer mitochondrial membranes  
D) Heart muscle has a high rate of oxidative metabolism, and therefore requires twice as much cytochrome c as QH<sub>2</sub> for electron transfer to proceed normally
5. In the  $\alpha$ -helix the hydrogen bonds:  
A) Occur mainly between electronegative atoms of the R groups  
B) Occur only between some of the amino acids of the helix  
C) Are roughly parallel to the axis of the helix  
D) Occur only near the amino and carboxyl termini of the helix
6. Topoisomerases can:  
A) Convert L isomers of nucleotides to D isomers  
B) Interconvert DNA and RNA

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- C) Change the linking number ( $Lk$ ) of a DNA molecule  
D) Change the number of base pairs in a DNA molecule
7. Many types of molecules and molecular associations are required for the translation process. Which one of the followings are **not** directly involved in translation.
- A) DNA  
B) mRNA  
C) Aminoacyl-tRNA  
D) Peptidyl transferase
8. How many chiral centers does isoleucine have?
- A) 1  
B) 2  
C) 3  
D) None
9. Both prokaryotic and eukaryotic promoters:
- A) Contain AT-rich region  
B) Interact with transcription factors  
C) Are influenced by base sequences thousands of base pairs away, which increase their activity  
D) Have all the above properties
10. Which of the following amino acids carry positive charge?
- A) Glycine  
B) Aspartate  
C) Threonine  
D) Lysine

## II. Assays (60%)

1. Match the descriptions to the appropriate enzyme(s) listed below. (There can be more than one answer to a question.) (10%, 2% each)
- (a) Citrate synthase; (b) Isocitrate dehydrogenase; (c) Pyruvate dehydrogenase; (d) Succinate dehydrogenase; (e) Succinyl-CoA synthetase
- i. \_\_\_\_ Catalyzes the committed step in the citric acid cycle  
ii. \_\_\_\_ The only membrane-bound enzyme in the citric acid cycle  
iii. \_\_\_\_ Catalyzes the substrate-level phosphorylation of ADP or GDP  
iv. \_\_\_\_ Regulated by reversible phosphorylation  
v. \_\_\_\_ Activated by AMP or ADP
2. How would the SOS response in *E. Coli* be affected by a mutation in the *lexA* gene that prevented autocatalytic cleavage of the LexA protein? (10%)
3. Explain the process of fatty acid synthesis. (10%)

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4. Free palmitate is activated to its coenzyme A derivative (palmitoyl-CoA) in the cytosol before it can be oxidized in the mitochondrion. If palmitate and [ $^{14}\text{C}$ ]coenzyme A are added to a liver homogenate, palmitoyl-CoA isolated from the cytosolic fraction is radioactive, but that isolated from the mitochondrial fraction is not. Please explain this observation. (10%)
5. Explain the processes of *lac* operon and *trp* peron. (10%, 5% each)
6. Explain the mechanism of RNA interference. (10%)