

編號: 82 系所: 生物資訊研究所

科目: 生物化學

本試題是否可以使用計算機:  可使用,  不可使用 (請命題老師勾選)

**A. Please choose the correct answer (only one answer) for each of the questions.  
(40%)**

1. An enzyme that is common in both glycolysis and gluconeogenesis:
  - a. Phosphofructokinase-1
  - b. Glucokinase
  - c. Aldolase
  - d. Fructose bisphosphatase
  
2. In the conversion of 1 molecule of acetyl CoA to carbon dioxide, how many O<sub>2</sub> molecules are consumed or produced directly by the reactions of the citric acid cycle?
  - a. 0 consumed or produced
  - b. 2 produced
  - c. 1 consumed
  - d. 2 consumed
  
3. Which enzyme is activated by direct binding of cAMP to a regulatory subunit?
  - a. Adenylate cyclase
  - b. Protein kinase A
  - c. Phosphorylase kinase
  - d. Protein phosphatase
  
4. In most tissues, an increase in the following ratio directly causes an increase in TCA cycle activity:
  - a. NAD<sup>+</sup>/NADH
  - b. ATP/ADP
  - c. GTP/GDP
  - d. NADH/NAD<sup>+</sup>
  
5. Decreases fluidity of a biological membrane.
  - a. Increased temperature
  - b. Increased number of cis double bonds in fatty acyl chains
  - c. Increased content of short chain fatty acyl group
  - d. Increased content of cholesterol

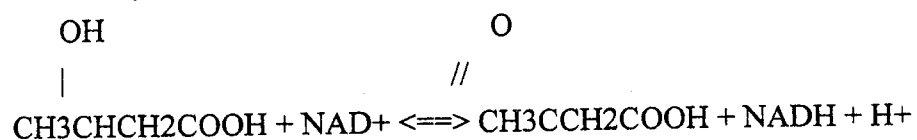
(背面仍有題目, 請繼續作答)

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6. An enzyme that catalyzes the reaction shown below is called a/an



- isomerase.
  - dehydrogenase.
  - transferase.
  - dehydrase
7. In myoglobin and hemoglobin, oxygen binds directly to
- Fe<sup>2+</sup> in the heme.
  - Fe<sup>3+</sup> in the heme.
  - the proximal histidine.
  - the distal histidine.
8. Protein secondary structures such as a helices and b sheets are stabilized mainly by
- disulfide bond formation.
  - Van der Waals forces.
  - hydrogen bond formation.
  - hydrophobic interactions.
9. Zinc-finger motifs in proteins are frequently associated with
- nucleotide binding.
  - protein-protein interactions.
  - Ca<sup>2+</sup> binding.
  - DNA binding.
10. Which amino acid is usually an alpha-helix breaker?
- Tyrosine
  - Tryptophan
  - Valine
  - Proline
11. The precursor of serine, glycine, and cysteine is
- oxaloacetate.
  - succinate.
  - pyruvate.
  - phosphoglycerate.

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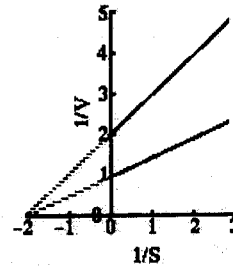
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\* According the right panel, please answer the following three questions.

12. The  $V_{max}$  of the enzyme is

- a. 4 micro-mol/min
- b. 2 micro-mol/min.
- c. 1 micro-mol/min.
- d. 0.5 micro-mol/min.



Dependence of enzyme rate  $v$  ( $\mu\text{mol}/\text{min}$ ) as a function of substrate concentration  $S$  ( $\text{mM}$ ). Also shown is the dependence of the rate in the presence of an inhibitor, present at a concentration of 2  $\text{mM}$ .

13. The  $K_m$  of the substrate is:

- a. 4  $\text{mM}$
- b. 2  $\text{mM}$
- c. 1  $\text{mM}$
- d. 0.5  $\text{mM}$

14. The type of inhibitor shown in this plot is

- a. competitive.
- b. uncompetitive.
- c. suicide.
- d. non-competitive.

15. Insulin promotes glucose uptake into muscle cells by affecting what process?

- a. Tyrosine phosphorylation of hexokinase
- b. Recruitment of GLUT 4 to the plasma membrane
- c. Increasing synthesis of GLUT 4
- d. Tyrosine phosphorylation of GLUT 4

16. Which reaction is catalyzed by catalase?

- a.  $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}^+ + \text{HCO}_3^-$
- b.  $2 \text{CO} + \text{O}_2 \rightarrow 2 \text{CO}_2$
- c.  $2 \text{O}_2^- + 2 \text{H}^+ \rightarrow \text{H}_2\text{O}_2 + \text{O}_2$
- d.  $2 \text{H}_2\text{O}_2 \rightarrow 2 \text{H}_2\text{O} + \text{O}_2$

17. Which of the following types of bonds or interactions are LEAST likely to be involved in stabilizing the three-dimensional folding of most proteins?

- a. Hydrogen bonds
- b. Electrostatic bonds
- c. Hydrophobic interactions
- d. Ester bonds

(背面仍有題目,請繼續作答)

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18. The rate-limiting step of fatty acid synthesis is
- acetyl CoA carboxylase
  - ATP-citrate lyase
  - malic enzyme
  - pyruvate dehydrogenase
19. Substrate-level phosphorylation in the citric acid (Krebs) cycle depends directly on the energy of the
- thioester bond of succinyl CoA
  - oxidative decarboxylation of isocitrate to alpha-ketoglutarate
  - formation of citrate from oxaloacetate and acetyl CoA
  - FAD-dependent oxidation of succinate to fumarate
20. Two-dimensional (2-D) gel electrophoresis performed under denaturing conditions can be used to separate proteins according to which of the following characteristics?
- | First Dimension             | Second Dimension         |
|-----------------------------|--------------------------|
| a. subunit molecular weight | density                  |
| b. density                  | charge                   |
| c. amino acid composition   | charge                   |
| d. isoelectric point (pI)   | subunit molecular weight |

**B. Please answer the following questions. (60%)****I. Please describe the principles of following chromatography. (9%)**

- Ion exchange chromatography (3 points)
- Gel filtration chromatography (3 points)
- Affinity chromatography (3 points)

**II. Genomes of several species had been sequenced, please describe the strategies as you know. (8 %)****III. Please give some examples for the purpose of DNA chips. (8 %)****IV. To become mature proteins, polypeptides must fold to their native conformation. Beside, posttranslational modification has been reported to play an important regulation to achieve proteins' function. Please describe several kinds of protein modification and their purposes. (10 %)**

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V. The following RNA sequence will fold up to form a stem-loop structure. Underline the exact regions of the sequence that will form the stem (3 %)

5' GATCTTGGGATCGAAACGTATGCTTTTCGATCCCTATGTGC 3'

VI. Please briefly answer the function of following signal molecules. (10%)

1. MAP Kinase (2 points)
2. cAMP (2 points)
3. Nitric oxide (2 points)
4. Ca<sup>2+</sup> (2 points)
5. Protein phosphatase (2 points)

VII. Please explain the following terms and its purpose or function (12%)

1. Reporter gene (3 points)
2. Mutagenesis (3 points)
3. BLAST (basic local alignment search tool) (3 points)
4. SNPs (3 points)