

科目：生物化學 適用：應化所

編號：445

考生注意：

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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；試題須隨卷撤回。

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I. Single choice (40%, 2% each)

1. Which one of the following statements is most true of the TCA cycle?
  - a. It participates in the synthesis of glucose from pyruvic acid.
  - b. Some of the enzymes are located in the cytoplasm.
  - c. It is an endergonic series of reactions.
  - d. Two NADH are produced per turn.
2.  $\beta$ -oxidation of fatty acids in liver:
  - a. Requires fatty acids with an even number of carbon atoms.
  - b. Produces only acetyl CoA.
  - c. Requires the citric acid cycle for ATP production.
  - d. Occurs primarily in the mitochondrial matrix.
3. Which of the following intermediates in the oxidation of odd-chain fatty acids is likely to appear in the urine in vitamin B12 deficiency?
  - a. Formic acid.
  - b. Methylmalonic acid.
  - c. Pentanoic acid.
  - d. Propionic acid.
4. What is the major mechanism for inhibition of glycolysis in liver during gluconeogenesis?
  - a. GK is inhibited by the high concentration of G-6-P.
  - b. Phosphorylation of PFK-2/F-2,6-BPase leads to decreased levels of F-2,6-BP, which is an allosteric activator of PFK-1.
  - c. Increased hepatic acetyl CoA inhibits the activity of PDH.
  - d. Hydrolysis of G-6-P to glucose decreases the availability of G-6-P for glycolysis.
5. Which of the following amino acids is required in the diet of a healthy adult?
  - a. Aspartate.

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- b. Serine.
- c. Tryptophan.
- d. Cysteine.
6. What is the primary the metabolic fate of lactate released from muscle during intense exercise?
- a. Excretion in urine as sodium lactate.
  - b. Gluconeogenesis in liver for replenishment of blood glucose.
  - c. Conversion into pyruvate for aerobic metabolism in liver and other tissues.
  - d. Gradual reuptake in muscle for metabolism during the recovery phase following exercise.
7. During the early stages of dieting, it is relatively easy to lose a few pounds rapidly, but then the rate of weight loss slows down to less than 250g/day. Why?
- a. People are generally less committed to their weight-losing diet after the first few days.
  - b. The initial weight loss is the result of loss of water from blood and extravascular fluids.
  - c. The initial weight loss results from rapid consumption of liver and muscle glycogen.
  - d. The body switches from glucose to lipids as its major source of energy.
8. What is the net yield of ATP molecules if per molecule of fructose is converted to lactate in liver via glycolysis? The reaction occurs under anaerobic condition.
- a. 1.
  - b. 2.
  - c. 3.
  - d. 4.
9. To evaluate the energy savings achieved by phosphorylase, assume that, in the absence of phosphorylase, cleavage of each glucose residue from glycogen required hydrolysis

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of one molecule of ATP. On that basis, how many ATP molecules are required to degrade 1.0 g of glycogen to glucose? Assume that the molecular weight of any glucose residue is 162.

- a.  $1.2 \times 10^{21}$ .
- b.  $4.5 \times 10^{21}$ .
- c.  $3.7 \times 10^{21}$ .
- d.  $6.2 \times 10^{21}$ .

10. All of the following are considered "weak" interactions in proteins except?

- a. Peptide bond.
- b. Ionic bonds.
- c. Hydrogen bonds.
- d. Hydrophobic interactions.

11. Four samples of glucose are selectively labeled with  $^{14}\text{C}$  at one carbon atom: (a) at C1; (b) at C2; (c) at C3; (d) at C6. The glucose samples are converted to glucose-6-phosphate by action of hexokinase, and the glucose 6-phosphate is passed once through the pentose phosphate pathway. Under these conditions, which samples would yield  $^{14}\text{C}$ -labeled  $\text{CO}_2$ ?

- a. C1.
- b. C2.
- c. C3.
- d. C6.

12. How many ATPs could theoretically be formed from coupling the first three reactions of the citric acid cycle, based on  $\Delta G^{\circ\prime}$  values?

- a. 5.
- b. 10.
- c. 15.
- d. 1.

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13. Assume that biosynthesis of purines has lowered the alpha-ketoglutarate concentration.

How will this affect the concentrations of isocitrate and fumarate?

- a. Increase.
- b. Not change.
- c. Increase then decrease.
- d. Decrease.

14. How many nucleotides are in a double-stranded bacterial DNA if we know that 75% of the DNA encodes for a total of 2100 different proteins that have an average molecular weight of 30,000? Assume that the molecular weight of an amino acid residue is 100.

- a.  $5 \times 10^6$ .
- b.  $10 \times 10^6$ .
- c.  $15 \times 10^6$ .
- d.  $20 \times 10^6$ .

15. How many base pairs are there from -13 to +27 hypothetical DNA site?

- a. 10.
- b. 20.
- c. 30.
- d. 40.

16. The following apolipoprotein may play a role in the development of Alzheimer's disease:

- a. ApoB48.
- b. ApoB100.
- c. ApoE.
- d. ApoC.

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17. Which of the following enzymes is the rate-limiting enzyme in the biosynthesis of cholesterol?

- a. HMG CoA synthesis.
- b. HMG CoA reductase.
- c. Mevalonate kinase.
- d. Squalene synthase.

18. G-protein-coupled receptors have:

- a. Single-pass transmembrane domains.
- b. Seven transmembrane-spanning domains.
- c. Seven subunits.
- d. Seven single-pass transmembrane domains.

19. Which of the following is essential for gene transcription?

- a. RNA polymerase.
- b. DNA methylase.
- c. A CAAT box.
- d. Glucocorticoids.

20. Which of the following mechanisms is **not** involved in gene expression?

- a. Methylation of cytosine nucleotides.
- b. Intron splicing.
- c. Use of alternative promoters.
- d. Mutation of consensus sequences.

## II. Assays (60%)

1. The following represents a partial sequence in a lagging strand template:

3'-ACTGTCGATGGACCA-5'. What is the sequence of the corresponding (a) RNA primer, (b) Okazaki fragment, and (c) RNA primer if the template cytosines were first deaminated to uracils? (10%, (a) 3%; (b) 4%; (c) 3%)

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2. Adenine is spontaneously deaminated to hypoxanthine, and the latter can form a base pair with cytosine. If this occurs, what mutated base pair would be formed in DNA from an A • T base pair? (10%)
3. In which of the following preparations do you expect the addition of fMet-tRNA<sup>fMet</sup> to lead to stimulation of protein synthesis? (a) Cytoplasmic ribosomes from *E. coli*; (b) cytoplasmic ribosomes from reticulocytes; (c) mitochondria from reticulocytes. Why? (10%)
4. Define each of the following terms: (20%, 4% each)  
(a) Ubiquitin; (b) TCA cycle; (c) Shine-Dalgarno sequence; (d) polycistronic (e) aminoacyl adenylate.
5. 2, 3-bisphosphoglycerate concentration increases in the red blood cells during adaptation to higher altitudes and in anemia. Explain why? (10%)

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