

科目：生物化學 適用：生醫所生醫組

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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編號：501

I. 單選題 (每題 2 分，共 20 分)：

1. Which of the following is/are true, concerning genomic libraries?
 - A) Genomic libraries often use cloning vectors derived from plasmid vectors.
 - B) Total restriction digestion frequently is used to ensure that the library contains every gene.
 - C) Genomic libraries include both expressed and non-expressed DNA from an organism.
 - D) All of the above
2. If human blood is not maintained at close to $\text{pH} = 7.4$, a person can develop
 - A) Acidosis
 - B) Alkalosis
 - C) Diabetes
 - D) Both a and b
 - E) None of the above
3. Phosphorylation that changes an enzyme's activity is an example of _____.
 - A) covalent modification
 - B) allosteric regulation
 - C) sequential modification
 - D) site-directed mutagenesis
4. The interconversion of which pair of substrates is used as a regulatory point in gluconeogenesis?
 - A) lactate and pyruvate
 - B) phosphoenolpyruvate and 2-phosphoglycerate
 - C) fructose 1,6-bisphosphate and fructose 6-phosph
 - D) dihydroxyacetone phosphate and glyceraldehyde-3-phosphate
5. Stem-loop structures in RNA resemble the _____ form of double-helical DNA.
 - A) A
 - B) B
 - C) Z
 - D) supercoiled circular
6. In packaging the eukaryotic DNA into nucleosomes, it is thought that the requirement for _____ and their synthesis is a cause of the slower rate of movement of the replication fork.
 - A) Okazaki fragments
 - B) Larger DNA molecules
 - C) Increase number of accessory proteins
 - D) Histone proteins
 - E) Lagging strands
7. A compound with a greater free energy of hydrolysis than ATP is
 - A) Glucose 1-phosphate
 - B) Any phosphoester
 - C) Phosphoenolpyruvate
 - D) Acetyl CoA
 - E) All of the above
8. The three dimensional structure of most proteins is largely determined by
 - A) Other proteins which fold them
 - B) Weak noncovalent interactions
 - C) Denaturation
 - D) Hydrogen bonds
 - E) All of the above

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9. Gluconeogenesis is

- A) The result of α -amylase activity B) The formation of glycogen
C) The formation of starches
D) The formation of glucose from noncarbohydrates
E) The formation of glucose from other carbohydrates

10. DNA synthesis is often measured by using radioactive

- A) Biotin B) Thymine C) Thiamine
D) Thymidine E) All of the above

II. 簡答題 (共 80 分)：

1. True or false: (2% each, total 10%)

- (a) Most purification procedures for proteins are carried out at room temperature.
- (b) Triacylglycerols are more efficient to store than carbohydrates because their hydrophobicity allows them to be stored in adipose cells without large amounts of bound water molecules.
- (c) Topoisomerases cut one or both coiled DNA strands, wind the ends by rotation and then rejoin the cut ends.
- (d) Operons are a common gene arrangement found in all living organisms.
- (e) An individual is treated for cystic fibrosis by a recombinant virus administered through an inhaler so the virus can "infect" the cells lining the lungs. In the lungs, the recombinant DNA is incorporated into the patient's genomic DNA and produces a protein product that helps relieve the symptoms of the disease. Children born to this patient after the treatment can be expected to also carry the recombinant genes and benefit from them if they too suffer from cystic fibrosis.

2. Match these molecules with their biological roles. (2% each, total 16%)

- | | |
|-------------------|--|
| __ glycogen | (a) blood clotting |
| __ starch | (b) carbohydrate storage in plants |
| __ sphingolipids | (c) carbohydrate storage in animal liver |
| __ chitin | (d) exoskeleton of insects |
| __ prostaglandins | (e) necessary for sight |
| __ vitamin A | (f) viscosity, lubrication of extracellular secretions |
| __ hyaluronate | (g) mediates pain and inflammation |
| __ thromboxanes | (h) important component of myelin membranes |

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3. (a) Define the primary structure of a protein. (3%)
(b) Name two factors (bonds or other forces) that contribute to stabilizing the native structure of a protein, and describe one condition or reagent that interferes with each type of stabilizing force. (4%)
(c) What is an "oligomeric" protein? (3%)
4. Lysosomes contain many degradative enzymes that are used to degrade complex molecules transported to these organelles. Describe the two mechanisms that prevent these enzymes from degrading the cells in which lysosomes are found. (6%)
5. Explain how amplification of a hormonal signal takes place; illustrate with a specific example. (6%)
6. Briefly describe how a transgenic animal is produced. (4%)
7. Polypeptide chain elongation in *E. coli* occurs by the cyclical repetition of three steps.
(a) What are these steps and what cellular components are necessary for each of them to occur? (6%)
(b) A new antibiotic was discovered that inhibits prokaryotic protein synthesis. In the presence of the antibiotic, protein synthesis can be initiated, but only dipeptides that remain bound to the ribosome are formed. What specific step of protein synthesis is likely to be blocked by this antibiotic? (1%)
8. A DNA sequence that may be present as only a single copy in a large mammalian genome can be amplified and cloned using the polymerase chain reaction (PCR). Describe the steps and reaction components required in a PCR experiment. Illustrate the steps in one round only. (6%)
9. Hemoglobin is an iron-containing protein for oxygen binding.
(a) What is the effect of pH on the binding of oxygen to hemoglobin (the Bohr Effect)? (2%)
(b) Briefly describe the mechanism of this effect. (4%)
10. Discuss how a mutation in DNA could be harmful or beneficial to an organism. (4%)
11. What are RFLPs and how are they used in forensic DNA fingerprinting technology? (5%)