國 立 清 華 大 學 命 題 紙

94 學年度微機電系統工程研究所碩士班入學考試

科目 生物化學 科目代碼 2307 共三頁 第一頁 請在答案卷內作答

Part One (Questions 1-10): 選擇題

1. (4%) Most enzyme-catalyzed reactions occur in
   (a) picoseconds,
   (b) nanoseconds,
   (c) microseconds,
   (d) miniseconds,
   (e) seconds.
2. (4%) The thickness of the hydrophobic core portion of biological membrane is around:
   (a) 2 minimeter,
   (b) 2 micrometer,
   (c) 200 nanometer,
   (d) 20 nanometer,
   (e) 2 nanometer.
3. (4%) The substance with the highest energy content is:
   (a) protein molecules,
   (b) glucose molecule,
   (c) covalent C-C bond,
   (d) hydrogen bond.
4. (4%) Which of the following is commonly used as a protecting group during peptide synthesis:
   (a) tert-butyloxycarbonyl,
   (b) dicyclohexylcarbodimide,
   (c) dicyclohexylurea,
   (d) hydrogen fluoride,
   (e) phenyl isothiocyanate.
5. (4%) Which of the following is not a mechanism for the regulation of the catalytic activity of enzymes:
   (a) phosphorylation of the serine residue,
   (b) proteolytic cleavage of an inactive enzyme precursor,
   (c) binding of regulatory peptides via disulfide bonds,
   (d) binding of regulatory proteins via noncovalent bonds.

6. (4%) The phosphoinositol portion of the phosphatidyl inositol molecule is called which of the following:
   (a) the amphipathic moiety,
   (b) the hydrophobic moiety,
   (c) the hydrophilic moiety,
   (d) the micelle,
   (e) the polar head group.
7. (4%) The major product of the fatty acid synthase complex in mammals is :
   (a) oleate,
   (b) stearate,
   (c) stearoyl CoA,
   (d) palmitate,
   (e) linoleate,
   (f) palmitoyl CoA.
8. (4%) The observation that the incubation of photosynthetic algae with $^{14}CO_2$ in the light for a very brief time (5 seconds) led to the formation of ^{14}C-labeled 3-phosphoglycerate suggested that the $^{14}CO_2$ was condensing with some two-carbon acceptor. The acceptor was:
   (a) acetate,
   (b) acetaldehyde,
   (c) acetyl CoA,
   (d) acetyl phosphate,
   (e) none of the above.
9. (4%) You have been supplied with the oligonucleotide d(GGAATTCC) and an isolated and purified DNA restriction fragment that has been excised from a longer DNA molecule with a restriction endonuclease that produces blunt ends. Which of the following reagents is not needed if you try to tailor the ends of the fragment so it could be inserted into an expression vector at a unique EcoR1 cloning site:
   (a) all four dNTPs,
   (b) EcoR1 restriction endonuclease,
   (c) ATP,
   (d) DNA ligase,
   (e) polynucleotide kinase.

10. (4%) Which of the following portions of a longer duplex DNA segment are likely to be the recognition sequences of a restriction enzyme:

(a) 5'-AGTC-3'
3'-TCAG-5'

(b) 5'-ACCT-3'
3'-TGGA-5'

(c) 5'-ATCG-3'
3'-TAGC-5'

(d) 5'-ACGT-3'
3'-TGCA-5'

Part Two (Questions 11-15) 問答題

11. (15%) In the *lac* operon, describe the probable effects on gene expression of (1) mutations in the *lac* operator, (2) mutations in the *lac*1 gene, and (3) Mutations in the promoter.

12. (10%) Methionine is one of the two amino acids having only one codon. Yet the single condon for methionine can specify both the initiating residue and interior Met residues of polypepides synthesized by *E. coli*. Explain how this is possible.

13. (15%) Please describe the Michaelis-Menten model accounting for the kinetic properties of many enzymes. Please also derive the Michaelis-Menton equation for describing the relationship between the rate of catalysis, V, and the substrate concentration, [S].

14. (10%) Please describe the mechanisms used by (a) polar and charged molecules, (b) ions and (c) water to move across the plasma membrane of a mammalian cell.

15. (10%) Please describe the chemiosmotic model of oxidative phosphorylation.