

八十六學年度醫射生物研究所系(所) _____ 組碩士班研究生入學考試

科目 生物化學 科號 4101 共 四 頁第 1 頁 *請在試卷【答案卷】內作答

Part 1: (25%)

1. Explain why β -sheets are unlikely to form folding nuclei. (4 %)
2. The pH dependence of the rate of the triose phosphate isomerase (TIM) reactions has characteristic pK's of 6.5 and 9.5. Histidine-95, a catalytically essential residue, has been shown to have a pK of 4.5. Why doesn't the pH rate curve indicate the existence of this pK? (5 %)
3. What are the ionic strengths of 1.0 M solutions of NaCl, $(\text{NH}_4)_2\text{SO}_4$, and K_3PO_4 ? In which of these solutions would a protein be expected to be most soluble; least soluble? (5 %)
4. Write out the reactions of the glycolytic pathway from glucose to lactate, using arrows and names of the intermediates and enzymes involved. (5 %)
5. Please match the lipoproteins and their functions below:

Lipoprotein	Function
<1>. () Chylomicrons	<a>. Transport endogenous (internally produced) triacylglycerols and cholesterol from the liver to the tissues (the liver synthesizes triacylglycerols from excess carbohydrates).
<2>. () Low density lipoprotein (LDL)	. Transport endogenous cholesterol from the tissues to the liver.
<3>. () High density lipoprotein (HDL)	<c>. Transport exogenous (externally supplied, eg. dietary) triacylglycerols and cholesterol from the intestines to the tissues.

(Leave the correct alphabets in order in the answer sheet) (6%)

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Part 2: (25%)

True or False (question 1-6),

if your answer is **False**, please correct the statement, 12 %

1. Isotopes "equal to" stable or radioactive forms of an element that same in atomic weight but are different chemical nature, used as tracers.
2. Glycoprotein is a protein containing at least one glycogen.
3. Gene library is a random collection of DNA fragments that includes all the genetic information of at least one species.
4. Nucleoside is a compound consisting of a purine base covalently linked to a hexose.
5. Plants and many bacteria can reduce nitrate back into ammonia by the action of nitrate reductases. this process is known as nitrification.
6. Aspartic acid and glutamic acid have positive charged R groups

Question 6-7, please choose **one** answer within the blank, 7%.

6. Much evidence suggests that the combination of a high plasma level of very- (high, low, or equal) density lipoproteins with a (high, low, or equal) level of high-density-lipoprotein is an important factor in causing atherosclerosis, the formation of thick deposits of cholesterol and its esters on the inner surfaces of blood vessels.
7. Monooxygenases catalyze reactions in which (only one, or two) of oxygen atoms would be incorporated in to the organic substrate. These enzymes require (one or two) substrate to serve as reductants of the two oxygen atoms of O₂.

Question 8, please draw right chemical structures, 6%

- 8.1. Urea
- 8.2. Acetyl-CoA
- 8.3. 5-methylcytosine

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科目 生物化學 科號 4101 共 四 頁第 3 頁 *請在試卷【答案卷】內作答

Part 3: (25%)

1. Please draw the structure of glycine in Zwitterion form. The Pk_{a1} and Pk_{a2} for glycine is 2.3 and 9.6, respectively. Please draw the predominant form of glycine at pH 1, 7 and 11, respectively (8%)

2. The initial coding sequence of a cDNA is

5' ATGGACCCTGAGACCTGCCCC---- 3'

3' TACCTGGGACTCTGGACGGGG— 5'

Assuming that this gene can be detected by using synthesized oligonucleotide (21mer) What sequence will you use to synthesize the oligonucleotide for (a) Southern (b) Northern hybridization? Please list all of the possible sequence for each question, and indicate the orientation of each oligonucleotide. Assuming that no intron occurs in the sequence. Do not use a degenerated sequence (6%)

3. The primary structure of protein A is deduced from the cDNA sequence. This protein is known to be phosphorylated in vivo by a kinase at a specific amino acid residue. Now, this protein is phosphorylated by using [^{32}P]-orthophosphate and antibody of protein A is available in the laboratory. One researcher conducted a series of experiments and identified the amino acid residue which is phosphorylated. Please indicate the reasonable order to perform the experiments. (5%)
- identify the peptide containing radioactivity
 - digest the protein by specific endoproteinase
 - immunoprecipitate the protein
 - N-terminal sequencing and identify the amino acid residue with radioactivity
 - separate the peptide by reversed phase HPLC

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4. DNA sequence can be determined by using specific chemical reagents or by dideoxynucleotide chain termination method. Please describe the principles for both methods. The figure shown below is a result of chemical cleavage method. Please write down the sequence with the arrows. (6%)



Part 4: (25%)

Many hormones such as epinephrine, glucagon bind to their specific receptors to activate adenylate cyclase. Studies reveal that G protein is involved in this pathway of activation. Please answer the following questions.

1. What does "G protein" stand for?
2. How does the G protein control adenylate cyclase, and what is the role of GTP in this process?
3. Please indicate the role of hormone-receptor complex in this process.

Deoxyribonucleotides are formed by the reduction of ribonucleotides. The enzyme for this reaction is ribonucleotide reductase. This enzyme consists of two subunits of B1 and B2.

1. What is the substrate and product of this enzyme?
2. Please describe the special features of the two subunits.