八十四學年度輻射生物研究所所＿＿＿組碩士班研究生入學考試

科目 生物化學 科號 340 共 四 頁第 1 頁 *請在試卷【答案卷】內作答

Part I.

1. A protein is found on the plasma membrane but is believed to be synthesized in nuclei. How this protein is translocated from the synthesis site to final location? (7%)

2. Hexokinase catalyzes the reaction:

$$ATP + Glucose \rightleftharpoons ADP + Glucose\text{-}6\text{-}phosphate.$$

A student incubated 40 mM ATP and 20 mM Glucose with hexokinase at pH 7.0 and 25°C. Please calculate the concentrations of the reactants and products at equilibrium, assuming $\Delta G^{o'} = -13.8$ KJ.mol^{-1}, and $R = 8.31$ JK^{-1}mol^{-1}. (5%)

3. Please briefly describe how the citric acid cycle is regulated. (10%)

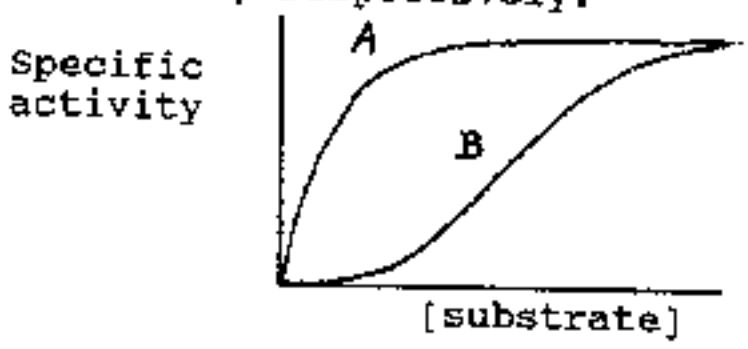
4. Please draw an energy diagram schematically indicating the electronic states of chlorophyll and their most important modes of interconversion. (3%)

5. Please briefly explain the terms below:
   (a). Isozyme
   (b). Western blot
   (c). Gluconeogenesis
   (d). Competitive inhibition
   (e). Symport. (10%)

6. DEAE-cellulose contains functional group of diethylaminoethyl ($-OCH_2CH_2N(C_2H_3)_2$), while CM-cellulose contains carboxymethyl ($-OCH_2COOH$). Please indicate:
   (a). What types of chromatography they are?
   (b). How are they working in the purification of proteins? (6%)

7. An enzyme is isolated. How do you determine how pure it is? (4%)

8. Two enzymes, A and B, display substrate concentration curves as shown below. Please indicate their possible characteristics, respectively. (5%)



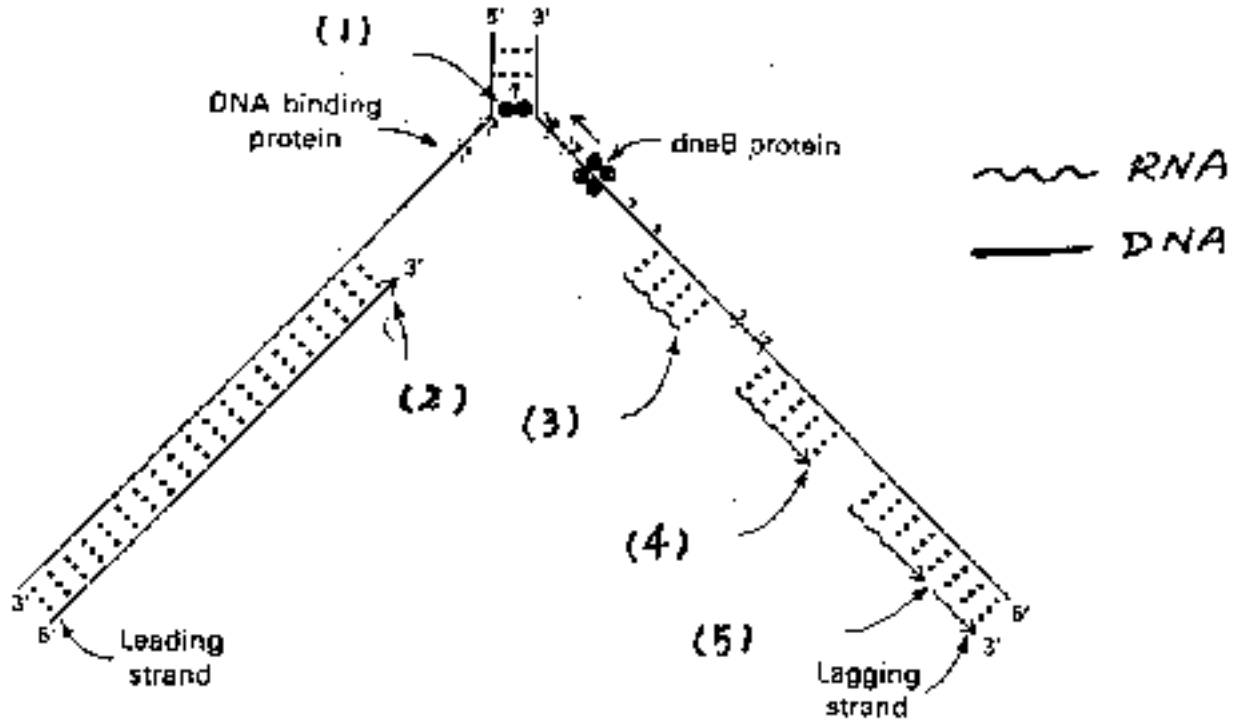
Part II.

1. There are five proteins: A, B, C, D and E. The molecular weight of the proteins is 10, 30, 30, 50 and 50 KDa, respectively. The pI of the proteins is 5, 5, 6.5, 7.5 and 7.5 respectively. When the proteins are mixed together, and you are asked to seperate them in polyacrlyamide gel,
   (1) By what method can they be seperated?
   (2) What is the basic theory behind the method?
   (3) Draw a figure to indicate the relative positions of the proteins once they are seperated. (6%)

2. What is the lactose operon? How does it operate? If a mutation that increases by a factor of 100 the binding affinity of *lac* repressor without changing the binding affinity for nonspecific site on DNA, what will happen? (10%)

3. Please fill the protein (enzyme) used in the following reactions. (10%)

in E. Coli



4. Please indicate the change of the following in plasma (1,2 and3) and liver (4, 5 and 6) after three days of starvation. (↑ increase; ↓ decrease; — no change) (6%)

(1) glucose
(2) ketone bodies
(3) fatty acids

(4) glycogen
(5) oxalacetate
(6) acetyl CoA

5. (1) A partial genomic DNA sequence:

--TCCCACGATATAAAGAAAGCAGTCACCACAACTTCTGGAA ATG GAC TGC—

Arrow indicates the transcription start site. If this gene is transcribed, what will be the sequence of the mRNA (according to the sequence listed above)?

(2) If the sequence at 3' end of a mRNA is:

--AUAUGTGUGAAUAAACCAAUGGCAAAAAAAAAAAAAAA

What will be the genomic DNA sequence deduced from this part of mRNA assuming that there is no intron in this region? (6%)

6. The ε-amino group of lysine has a pKa of 10.5. What fraction of these groups will be protonated (i.e., $-NH_3^+$ rather than $-NH_2$) in a dilute solution of lysine (4%)

(1) at pH 9.5
(2) at pH 10.5

7. _____ bonds hold bases of one nucleotide strand to bases of the other nucleotide strand of a DNA double helix. (2%)

8. The amino acid sequences of part of lysozyme from wild-type T4 bacteriophage and a mutant are

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-Thr-Lys-Ser-Pro-Ser-Leu-Asn-Ala-Ala-Lys-      Wild-type
-Thr-Lys-Val-His-His-Leu-Met-Ala-Ala-Lys-      Mutant
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(1) Could this mutant have arisen by the change of a single base pair in T4 DNA? Please explain.
(2) What is the base sequence of the mRNA that codes for the sequence of five amino acids in the wild-type phage that is different in the mutant? (6%)

Second Position

First Position (5' End)	U	C	A	G	Third Position (3' End)
U	UUU, UUC: Phe; UUA, UUG: Leu	UCU, UCC, UCA, UCG: Ser	UAU, UAC: Tyr; UAA: Stop; UAG: Stop	UGU, UGC: Cys; UGA: Stop; UGG: Trp	U, C, A, G
C	CUU, CUC, CUA, CUG: Leu	CCU, CCC, CCA, CCG: Pro	CAU, CAC: His; CAA, CAG: Gln	CGU, CGC, CGA, CGG: Arg	U, C, A, G
A	AUU, AUC, AUA: Ile; AUG: Met	ACU, ACC, ACA, ACG: Thr	AAU, AAC: Asn; AAA, AAG: Lys	AGU, AGC: Ser; AGA, AGG: Arg	U, C, A, G
G	GUU, GUC, GUA, GUG: Val	GCU, GCC, GCA, GCG: Ala	GAU, GAC: Asp; GAA, GAG: Glu	GGU, GGC, GGA, GGG: Gly	U, C, A, G